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MYTHIC DRY-PAINTINGS OF THE NAVAJOS.

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I DESIRE, in this article, to call the attention of ethnographers to some pictures which are among the most transitory in the history of human art. They are the work of the Navajo Indians, a people who make no graven images of their gods, who do not decorate skins or robes, who place no symbols on their rude and rarely-made pottery, and may be said to have no rock inscriptions. A few slightly scratched sketches on the cliffs of Arizona and New Mexico may, perhaps, be attributed to them; but the vast majority of carvings on stone in their country, and all of the most permanent character, are the work of the sedentary races. Seeing no evidence of a symbolic art among them, one might readily be led to suppose that they possessed none. Such was my opinion for two years after I had come to reside near them. Such is the opinion of many white men, who have lived for periods of from ten to twenty years among them.

During my residence of nearly four years in New Mexico I had heard of these drawings through the less conservative Indians and through a Mexican who had been many years captive among them. But it was not until last November, when I made a special journey to the Navajo country under the auspices of the Bureau of Ethnology, that I obtained unrestricted access to the medicine-lodge, saw the hieratic figures drawn, and was given permission to sketch them, much to the horror of the large majority of the assembled multitude.

The medicine-lodge, on the floor of which these pictures are made, is a simple conical structure of logs in the shape of an

Indian skin tent. It is about twenty-five feet in diameter at the base, internally, and about eight feet high under the apex. The only apertures are a smoke-hole above and a door, communicating through a short passage-way, in the east. The fire is built in the center of the floor except when the pictures are being made, then it is removed further to the east to make room for them. It is so dark in the lodge that on a brief winter day the artists must begin their work before sunrise if they would finish before night-fall and this it is essential they should do.

When the call is sounded in the morning, several young men go forth and bring in a quantity of dry sand in blankets; this is thrown on the floor and spread out over a surface twelve feet or more in diameter, to the depth of about three inches; it is leveled and made smooth by means of the broad oaken battens used in weaving.

The drawings are begun as much towards the center as the design will permit, due regard being paid to the precedence of the points of the compass; the figure in the east being begun first, that in the south, second, that in the west, third, that in the north, fourth. The figures in the periphery come after these. The reason for working from within outwards is a practical one; it is that the operators may not have to step over and thus risk the safety of their finished work.

While the work is in progress the chief shaman does little more than direct and criticise; a dozen or more young men perform the manual labor, each working on a different part. These assistants have had a certain ceremony of initiation performed over them before they are admitted to the lodge or allowed to help when these pictures are made; but they need not be skilled medicine-men or even aspirants to the craft of the shaman. They get nothing for their pains but their food, which, however, is abundant. Three times a day the person, for whose benefit the dance is performed, sends in enough mush, corn-cake, soup and roasted mutton to satisfy to the utmost the appetites of all in the lodge. The shaman, or *hathàli* (chanter or singer), as the Navajos call him, gets a rich present for his services.

The pictures are drawn according to an exact system, except in certain well-defined cases, where the limner is allowed to indulge his fancy. This is the case with the embroidered pouches the gods carry at the waist (see Plate XXXIII). Within reasonable

limits the artist may give his god as handsome a pouch as he wishes. On the other hand, some parts are measured by palms and spans, and not a line of the sacred design can be varied in them; straight and parallel lines are drawn on a tightened cord.

The pigments are five in number: they are black made of charcoal; white, of white sandstone; yellow, of yellow sandstone; red, of red sandstone, and "blue," of the black and white mixed in proper proportions; all ground into fine powder between two stones. The so-called blue is, of course, gray, but it is the only inexpensive representative of the cerulean tint they can obtain, and, combined with the other colors on the sandy floor, it looks like a real blue. These colored powders are kept on improvised trays of pine bark; to apply them, the artist grasps a little in his hand and allows it to flow out between the thumb and the opposed fingers. When he makes a mistake he does not brush away the color, he obliterates it by pouring sand on it and then draws the corrected design on the new surface.

The naked forms of the mythical figures are first drawn, and then the clothing is put on. Even in the representations of the *Bitses-nnez*, or long bodies, which are nine feet in length, the naked body of each is first made in its appropriate color—white for the east, blue for the south, yellow for the west, black for the north—and then the four shirts are painted on as shown in the picture (Plate XXXIII) from thigh to axilla.

It is the task of the shaman, when the work of painting is completed, to put the corn-pollen, emblem of fecundity, on the lips and breast of each divine form, and to set up the bounding plume-sticks around the picture. Then the one who gives the feast enters and is placed sitting on the form that belongs to the east—the white form—and looking eastward. Here the colored dust from various parts of the divine figures is taken and applied to corresponding parts of the patient, and many other ceremonies are performed, which it is not my purpose to relate here. When the patient has departed many of the spectators pick up the corn-pollen, now rendered doubly sacred, and put it in their medicine-bags. Some take dust from the figures on their moistened palms and apply it to their own bodies. If the devotee has disease in his legs, he takes powder from the legs of the figures; if in his head, he takes powder from the head, and so on.

By the time they are all done the picture is pretty badly

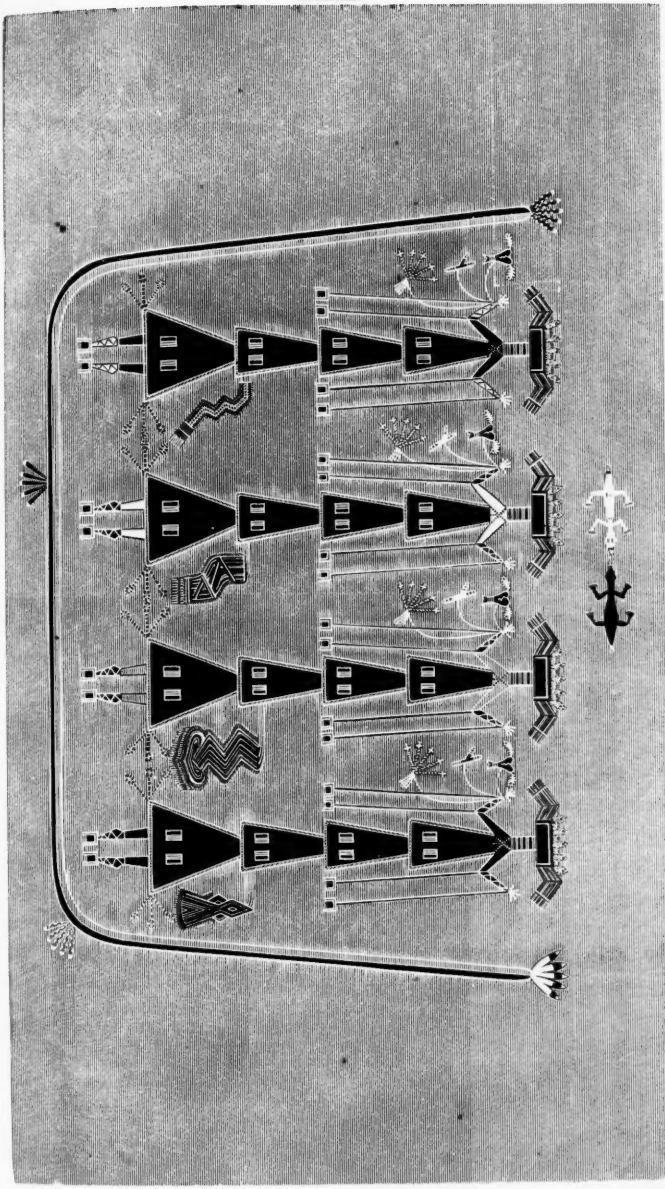
marred. Then it becomes the duty of the shaman to completely obliterate it; this he does with a slender wand, while he sings the song appropriate to this part of the ceremony. He begins with the figure belonging to the east, the white figure, and proceeds in the same order as was observed in making the picture, *i. e.*, in accordance with the apparent daily course of the sun. The figures at the margin are erased last, and when this is being done the bounding plume-sticks are knocked down. When no semblance of the picture is left the assistants gather the sand in their blankets, carry it to a little distance from the lodge and throw it away. Thus in half an hour after the completion of a large picture, ten or twelve feet in diameter, which has taken a dozen men, or more, eight or ten hours to construct, not a trace of it is left.

I have learned of seventeen great ceremonies of the Navajos, in which pictures of this character are drawn, and I have heard that there are, on an average, about four pictures to each dance. This would give us about sixty-eight such designs known to the medicine men of the tribe. But I learn that there are different schools or guilds among the medicine men who draw the pictures differently in some of the details, and that besides these seventeen great ceremonies there are many minor rites, with their appropriate pictures; so the number of designs in the possession of the tribe is probably much greater than that which I give.

The medicine-men aver that these pictures are transmitted from teacher to pupil, in each guild and for each ceremony, unaltered from year to year and from generation to generation. That such is strictly the case I cannot believe. No permanent design is preserved for reference, and there is no final authority in the tribe. The majority of the ceremonies can be performed only during the months when the snakes are dormant. The pictures are therefore carried over, from winter to winter, in the fallible memories of men. But I think it probable that innovations are unintentional, and that any changes which may occur are wrought slowly.

Out of this possible number of sixty-eight or more pictures I have seen seven, colored copies of which will, I hope, appear in some future report of the Bureau of Ethnology. The majority are too intricate to be reproduced in a satisfactory manner from a wood-cut on a page of this size, I therefore present illustrations of only two, and these of the simplest.

NORTH.



Navajo Dry-paintings. The Long Bodies.

The first four pictures in my collection are those of the *Dsilyidje hathal*, or chant among the mountains. This ceremony is also called *ilnasjingo hathal*, or chant in the dark circle of branches, from the great corral of piñon boughs in which it is performed. As the public ceremonies of the last night are varied and interesting, it is best known to the whites of all Navajo dances, and by our people is commonly called the hoshkawn dance, from the particular performance of the night, which seems most to strike the Caucasian fancy.

The whole ceremony is propitiatory to the *Yèïs*, or gods of the mountains; but when the Navajo prophet, who learned these mysteries, was brought around by a friendly god from place to place to be taught them, he was, on one occasion, brought into the house of the serpents. Now the worship of the snakes and water animals constitutes a separate dance, that of the *hojoni hathal*, or chant of terrestrial beauty, with its own pictures and ceremonies; but to indicate that the prophet visited the snakes in his wanderings and saw a portion of their mysteries, this picture, representing the home of the serpents, is drawn (Plate XXXII).

In the center of the picture is a circular concavity about six inches in diameter, intended to represent water. In all the other pictures where water was represented, a small bowl, I observed, was sunk in the ground and filled with water, which was afterwards sprinkled with powdered charcoal to give the appearance of a flat, dry surface. Closely surrounding the central depression are four parallelograms, each about four inches wide and ten inches long in the original pictures; the half nearer the center is red, the other half is blue; they are bordered with narrow lines of white. They appear in this and in some other pictures as something on which the gods seem to stand, and symbolize the *sha'bitlol*, or raft of sunbeams, the favorite vessels on which the divine ones navigate the upper deep. Red is the color proper to sunlight in their symbolism; but red and blue together represent sunbeams in the morning and evening skies when they show an alternation of red and blue. The sunbeam shafts, the halo and the rainbow are painted in the same colors, but they differ in form—the halo is a circle; the rainbow is curved and usually anthropomorphic, in Plate XXXIII, however, it is plumed. External to these sunbeam rafts, and represented as standing on them, are the figures of eight serpents—two in the east, white; two in the

south, blue; two in the west, yellow, and two in the north, black. They cross one another in pairs, forming four figures like the letter X. In each X the snake which appears to be beneath is made first, complete in every respect, and then the other snake is drawn over it in conformity with their realistic laws of art before referred to. The neck in all cases is blue, crossed with four bands of red, which, in the snake-like forms run diagonally, but in the man-like forms to be seen in other pictures, run transversely. The V-shaped marks on the backs of the snakes represent mottlings; the four marks at the end of each tail are for rattles. External to these eight snakes are four more of much greater length but colored to correspond with those already described. They seem to follow one another around the picture in the direction of the sun's apparent course, and form a frame or boundary. In the north-east is seen one of the *Yeïs*, who accompanied the Navajo prophet to the home of the snakes. In the extreme west is a black circular figure representing the mountain of *Dsilya-ithin*, whence they descended to visit the snakes. In the original picture the mountain was in relief—which I have not attempted to convey in my copy—a little mound of sand about ten or twelve inches high. From the summit of the mountain to the middle of the central waters is drawn a wide line in corn meal with four footprints depicted at intervals; this represents the track of the bear. Immediately south of the track is the figure of an animal drawn in the gray pigment, this is the grizzly himself, symbolizing the prophet.

During the journeys of the Navajo prophet before referred to, he came one night in the Carrizo mountains to the home of the four bear-gods (so runs the legend). They took from one corner of their cave a great sheet of cloud, unrolled it and exhibited to his view a picture. They told him that this picture must be drawn by the Navajos in their ceremonies; but as men had not the power of handling the clouds they should draw it on sand. This picture, a very elaborate one, not illustrated in this article, represents the *Yeïs* of the cultivated plants. It shows the central waters and the sunbeam rafts as in the first picture. It has four anthropomorphic figures extending from the center to different points of the compass, and highly conventionalized representations of the four principal domestic plants of the Indians—corn, bean, pumpkin and tobacco. The whole is surrounded on three

sides by the anthropomorphic rainbow. The body of the eastern god is white; that of the southern, blue; that of the western, yellow; that of the northern, black.

Here is an appropriate occasion to speak of Navajo symbolism in color. In all cases, as far as I could learn, the south is represented by blue, the west by yellow, the upper world by blue, the lower world by black and white in spots. Usually the east is represented by white and the north by black; but sometimes these colors are interchanged and the north becomes white while the east is black. The reasons for this change are too lengthy to be discussed here.

It is related in the myth which accounts for these mysteries, that this Navajo prophet, *Dzil'-yi-neyáni*, or Reared among the Mountains, was once led by the gods to a dwelling called the Lodge of Dew; it was built of dew-drops, and the door was made of many plants of different kinds. They entered and found four goddesses called *Bitses-ninez* or long bodies. The holy ones rose as the strangers entered, and they were very tall. The plumes on their heads almost touched the sky. They said to the prophet: "In the rites that you will teach your people when you return to them, you will invoke us by drawing our pictures. We stand here, one in the east, one in the south, one in the west and one in the north; but when you draw the picture you must place us all in the east."

The third picture in the series (Plate XXXIII) is supposed to be made in accordance with these instructions. To indicate their great height the figures are twice the length of any in the other pictures, except the rainbow figures, and each is clothed in four garments, one above another; for no one garment, they say, can be made long enough to cover such giant forms. The form immediately north of the center is done first, in white, and represents the east; that next to it, on the south, comes second in order, is painted in blue and represents the south. The form next below the latter is in yellow and depicts the goddess who stood in the west of the house of dew-drops. The figure in the extreme north is drawn last of all, in black, and belongs to the north. As before stated, these bodies are first made naked and afterwards clothed. The exposed chests, arms and thighs display the colors of which the entire bodies were originally composed. Some small animal called the *gloï* is sacred to these goddesses. Two of

these creatures are shown in the east, guarding the entrance to the lodge. The appendages at the sides of the heads of the goddesses represent the *glöï-bichá*, or head-dresses of *gloï* skins of different colors, which these mythic personages are said to wear. Each one bears, attached to the right hand, a rattle, a charm and a branch of choke-cherry in blossom (highly conventionalized). Some other adjuncts of the picture—the red robes embroidered with sunbeams, the forearms and legs clothed with clouds and lightning, the pendants from wrists and elbows, the blue and red armlets, bracelets and garters—are properties of nearly all the anthropomorphic gods shown in these pictures. The rainbow which encloses the group on three sides is not the anthropomorphic rainbow, it has no head, neck, arms or lower extremities. Five white eagle-plumes adorn its south-eastern end; five tail-plumes of some blue bird decorate the bend in the south-west; the tail of the red-shafted flicker is near the bend in the north-west, and the tail of the magpie terminates the north-eastern extremity. Throughout the myth not only is the house of dew spoken of as adorned with hangings and festoons of rainbows, but nearly all the holy dwellings are thus embellished.

The fourth picture represents the *Kátso-yisthan*, or great plumed arrows. These arrows are the especial great mystery, the potent healing charm of the dance. On the last night, many public *alilis* (shows, dances) may be given—shows of all sorts of societies and bands, shows adopted from alien tribes. From dark to dawn these continue around the great central fire and within the dark fence of evergreen branches. All of these may be changed, omitted, or have others substituted for them, except the dance of the great plumed arrow, this cannot be left out.

The three paintings remaining to be described are those of the *kledji-hathal* (chant of the night), or dance of the *Yeibichai* (grand-uncle of the gods). They represent some of the visions of another Navajo prophet named *Sho*. The myth recounting his adventures is interesting, but too long to be related here. In childhood and youth he showed signs of unusual wisdom. He often told his immediate relations that he held converse with the gods; but they doubted him until, as he grew older, he exhibited such unquestionable evidence of second-sight that the most skeptical were convinced. On one of his rambles he saw what he supposed to be a small herd of big-horn or Rocky-mountain

sheep, and went in pursuit. Four times he waylaid them and tried to shoot them, but each time when he drew his arrow to the head it would not leave the string. Then he knew the sheep to be divinities in disguise. He approached them; they threw off their sheep-skin coverings and revealed themselves as the *gáaskidi* or gods of plenty. They bore *Sho* to their home, admitted him to their sacred rites, taught him all their mysteries, and sent him back to his people that he might teach the mysteries to man. All his adventures and visions are embodied in the myths and rites of the *kledji-hathal.* When his mission was done he was taken back by the gods to dwell among them forever.

The form of the *gáaskidi* appears several times in the pictures. It is represented as having sheep's horns on the head, wearing a crown of black clouds garnished with lightning and fringed with sunbeams, bearing on the back a great sack made of the black thunder-cloud (said to be filled with all sorts of edible seeds and fruits), and leaning on a staff to indicate that the sack of plenty is a heavy burthen. Various other important characters of the Navajo mythology appear in these pictures.

One of the *Yeibichai* paintings delineates a very singular vision or revelation of the prophet *Sho.* It is called the *tsiznaöle,* or whirling sticks. On one occasion *Sho* was led by the gods to the shores of a dark lake, on the borders of which grew four stalks of sacred corn, each of a different color. In the center of the lake lay two logs, crossing one another at right angles; near the two extremities of each sat a pair of *Yeis,* male and female, making eight in all. On the shore of the lake stood four more *Yeis,* three of whom had staves, by means of which they kept the logs whirling around with a constant motion, while the *Yeis* sitting on the logs sang songs which are still preserved in the multitudinous chants of this rite under the name of *tsiznaöle-bigin,* or songs of the whirling sticks. All the circumstances of this strange scene are duly symbolized in the painting.

The two other pictures represent scenes in the dance of the *Yeibichai,* as *Sho* witnessed it among the gods, and with some modifications they would make fair representations of the dance as it is enacted by the Navajos to-day. The pictures are beautiful, and appear of high interest when their symbolism is explained; but I have not space to describe them, and, as before stated, they are too intricate to be suitably illustrated here.

THE RELATIONS OF MIND AND MATTER.

BY CHARLES MORRIS.

(Continued from p. 857, September number.)

V. The Conditions of Consciousness.

THE greatest mystery of the universe is the mystery of consciousness. That we can ever understand its innate nature is not to be expected. The mind may measure everything outside itself, but it cannot measure itself. The eye sees everything except the eye. There must always remain one thing unknown; that to and by which everything else is known. But though the nature of consciousness may be beyond our ken, its relations to matter and the mind are not necessarily so. Some of these relations are apparent. Others are within the reach of conjecture. We are therefore free to consider the mystery of consciousness from this point of view.

The character of consciousness has undoubtedly been greatly misapprehended, even by some very acute thinkers. It is customary to talk and write as if consciousness and mind were identical, or as if the words thought and consciousness were synonymous. It is, indeed, on this ground that the brain-mind theorists have based their deductions. They find that the existence of consciousness and the loss of brain force are closely related. Thought bears heavily upon the nerve cells. They sink beneath its pressure, lose their organization and yield energy, of which there is no evident physical display. This energy, as is claimed, is the element of consciousness, and its successive manifestations constitute the mind. But this amounts to a distinct claim that the consideration of the origin of consciousness involves that of the whole mental constitution, and that thought and the conscious perception of thought are one and the same thing; a hypothesis which may safely be disputed. For the mind impresses us with a sense of unity and continuity which certainly do not belong to consciousness. Its thoughts continue to exist, whether or not we are conscious of their existence. A thought may arise to our mental perception to-morrow, another next year, a third only after a decade of years. But they are evidently the same thoughts that we formerly knew. Their loss to sight has had no effect on their persistent existence. The action of consciousness or mental perception is, in fact, singularly like that of the eye. We per-

ceive to-day a landscape which we saw twenty years ago. There it has lain unchanged, all its salient points familiar to our sight, though we may have since wandered over half the world. So the eye of the mind wanders over a world of thoughts and suddenly perceives a mental landscape of which it lost sight twenty years before. There it lies, far more unchanged even than the physical landscape, for that has suffered innumerable changes, while the mental picture has seemingly remained utterly free from influences of change.

Whether consciousness is an energy in itself, or a forceless side product of energy is a question that has been considerably debated. Professor Huxley takes the latter view, and declares that consciousness is not an agent in determining action, but is a collateral result of the action. Professor Cope considers that "consciousness is not a necessary condition of energy," though "energy is a necessary condition of consciousness,"[1] and differs from Huxley in believing that consciousness exerts a directing influence over mental action. In respect to these views it is important to observe that the mental operations which are generally attended by consciousness are capable, in some cases, of proceeding unconsciously. There are on record many striking instances of the active operation of the mind during unconsciousness, or while consciousness was elsewhere directed, important results of reasoning being sometimes produced. There are few thinkers to whom minor instances of this kind have not occurred. Such cases would seem to prove that consciousness is not a necessary element of thought, and therefore not a determining agent in thought. On the other hand it must be remembered that such mental processes never begin in unconsciousness. In every recorded case they have been trains of thought with which consciousness was at first actively concerned, and whose movement has proceeded during a temporary lapse of consciousness, their final results again rising into the realm of conscious thought. Instances of this kind, however, are comparatively few, and seem only to occur where the preliminary train of thought has been intense, and the conscious attention close and active. This intense activity seems to set in movement energies of the mind, which, like a train of wheels set in motion by the hand, run on for some time after the acting agent has been withdrawn, and only slowly

[1] On Catagenesis, AMERICAN NATURALIST, Oct., 1884.

sink into a state of rest. There is not a shred of evidence that such mental movements ever take place without the preliminary attendance of consciousness. They may possibly be produced in a minor degree by less energetic consciousness, but in every case they soon sink to rest, as friction brings wheels to rest when their moving force is withdrawn. And the mind, no more than the wheels, seems capable of starting into activity without the aid of some directing agent.

There is nowhere in physical science evidence of the possible existence of a side product of energy which is not itself an energy. Motor energy varies in its mode of action, but every variant has a force influence of its own. A current of electricity, for instance, when resisted in its passage, here yields heat, there light and there magnetism, but the electricity loses in vigor with every such side expression, and the heat, light or magnetism at once exert force. The flash of light which gleams out when the electric current passes through the air, signifies a conversion of part of the current into the vibratory motion of light. May not the flash of consciousness which gleams out on the passage of motor energy from brain to mind signify a like partial side conversion of this energy? And if so it may possibly produce effects of its own, calling the mental organism into activity, or exerting some directing force upon the mental activities, as Professor Cope holds.

Under the hypothesis here advanced, that the brain is not the organ of the mind, but that there exists a distinct mental organism separate from though intimately related to the brain, the conditions of this organism must be closely analogous to those of all organized masses. We may, therefore, compare the mental organism with the crystal of some mineral. The latter is persistent, its internal relations of motion and attraction being in exact harmony. If undisturbed its internal conditions would remain unchanged indefinitely. But the motor energies of the external world penetrate the crystal and may disturb its organizing motions, producing changes in the relations of its particles. So a seed under conditions of isolation is a persistent organism, held intact by the harmony of its internal energies. Exposed to the inflow of external energy its organization changes. The instigating touch of such inflowing energy may set up long continuing changes in the motor relations of the particles of the seed,

and cause important modifications in its constitution. These cases seem closely analogous to what we know of the constitution of the mental organism, though the susceptibility of the latter to external influences is far greater. Yet it has a fixed organization through the harmony of its internal energies. It is exposed to the inflow of external energies through the medium of the brain. And its internal conditions change under the influence of these inflowing energies. But at every resting stage of its development it gains a stable condition of internal energies, which remains persistent during the temporary absence of consciousness. And consciousness appears to be a peculiar expression of the motor energy which flows from the brain into the mind. The nerve current appears to produce chemical disintegration in some highly unstable element of the brain cells, as in the muscle cells. The energy set free by this disintegration seems merely to intensify without changing the character of the influence producing it. It flows into the mental organism, and in so doing takes on the special condition of consciousness, or manifests consciousness as one of the effects of its intact with the mind. Its final effect, however, is to impress the mind with a new motor state, which directly or indirectly repeats the conditions of the instigating external energy.

If such be in any sense a correct conception of the character and relations of the mental organism, certain other necessary consequences follow. Not only does the mind receive energy from the brain, but its innate energies affect the brain, and set up disintegration in its cells like that produced by the nerve current. And the energy produced by this disintegration flows out as a nerve current over the motor nerves to the muscles, which it rouses into activity.[1] Such is the two-fold relation of the mind to external nature. But it has interrelations of its own. Thought energies flow from part to part of the mental organism, and ideas are evolved from their interconnection, much of the mental evo-

[1] The indications are that external energy does not flow directly into the mind, nor does mental energy flow outwards. In both cases an intermediate energy is used, that set free by chemical change in the tissues of the brain. The inflowing nerve current induces this change, and the mind is affected by the energy thus set free. In like manner the mind does not emit energy, or only to the slight extent necessary for inductive action. It exerts force on the brain cells, and induces a special emission of nerve energy. It constantly receives, but it never yields its stores of motor energy. It resembles a land-locked lake, into which hundreds of streams flow, but to which there is no outlet.

lution taking place through the interchange and combination of these internal energies. Yet the conditions of this activity seem identical with the other activities described. The mental organism has no more power of arbitrarily changing the relations of its own energies than has a crystal. All such changes arise through its connection with an external reservoir of energy, the brain. The seeming movements of thought through the mind are really actions of the energies of thought on the brain, the release of brain energy, and the inflow of this energy into another region of the mental organism. This mediation of the brain is signified by the physiological change that takes place, and also by the appearance of consciousness, a condition which seems only existent during motor interconnection of the brain and the mental organism.

We may reiterate here the fact that no organized mass—crystal, seed, solar system or mind—is capable of setting up new actions within itself, or arbitrarily instigating changes in its conditions of motor equilibrium. Such an action would be quite as impossible, if we may offer a homely illustration, as the old problem of a man lifting himself in a tub. Organizing motions cannot possibly change of themselves. Perturbations may arise through their interaction, as between the bodies of the solar system, but not permanent changes. And by the very conditions of their existence they resist change. All permanent change must come from the inflow and action of external energy, and it will be resisted to a degree in accordance with the rigidity of the organism. In the crystal, for instance, the resistance is vigorous. In the mind it is much less so, and varies extremely in minds of different degrees of development. If all mental change was produced by external impulse, then the brain might be its organ. But the existence of internal mental change renders this impossible. Such change can only take place under the instigation of external energy, and the brain is the source of this energy. The thoughts which seem to flow from region to region of the mind, evidently do so through the intermedium of the brain, since all activity of thought is attended with chemical change in the brain cells. And the energy thus yielded is the active agent in the new idea formed. It would seem as if every rapport between brain and mind instigated oxidation in the brain cells, the energy yielded flowing to the muscles, or to another region of the mind,

over the brain fibers, on the same principle as external energy penetrates to the mind over these fibers. In this view the mental organism has a space extension, equivalent to that of the cerebrum, and each region bears a relation like that of external nature to every other region.

The vividness of consciousness seems closely related to the degree of disturbance which it produces in the conditions of the mental organism. Energetic sensory impressions seldom fail to arouse consciousness, even if the mind is otherwise active. Less energetic ones may fail under such conditions. It is not unusual to discover that impressions have been unconsciously received during a period of mental abstraction. Possibly the movement of thought processes during unconsciousness is due to the small volume of energy engaged. An important fact, in this connection, is that unusual impressions arouse the consciousness more quickly and vividly than usual ones. The mind seems to become dulled to a sensation when it has become habituated to it. With every repetition of any special current of energy it seems to create less disturbance in the mind. This may be partly due, if the sensation is one to which immediate motor response is requisite, to the drafting off of part of the energy to the muscles. But even where this is not the case, and the impression is made wholly on the mind, its intensity diminishes with repetition, while all unusual sensations at once arouse active consciouness. Usual ones can only regain their original intensity of influence by an increase in their vigor. It would appear as if the vividness of consciousness depended upon the degree of change produced by a sensation in the mental conditions, and that each habitual sensation found accordant mental conditions, and therefore feebly affected the mind, while every new one produced a degree of change in accordance with its degree of rarity.

There is good reason to believe that every sensation that reaches the mind, however frequently repeated, is capable of awaking consciousness, and that only the completely reflex mental currents are absolutely unconscious. Thus certain tastes and sounds may be received with full consciousness an indefinite number of times. Yet with this rule the other holds good that an unfamiliar sensation most vividly arouses consciousness, and that all sensations less sharply affect the attention as they grow familiar. In all cases of the kind in which a sensation is seemingly

received unconsciously, this is due to the activity of the attention in some other direction. But if the attention is disengaged, every sensation may produce consciousness, no matter how familiar a visitant it may be to the mind.

The fact that when the mind is actively conscious in one direction it may be unconscious of the operation of important movements previously set up within its organism, or of the reception of new sensations, seems to indicate that the volume of consciousness which may exist at any one time is limited. It may sink below this volume, even to complete disappearance during inactivity of the brain, but it cannot rise above it. And the variations in the distribution of this volume of consciousness are of the utmost interest and importance. Now it seems to diffuse itself, and a broad field of the mind is perceived, the central ideas in the field of vision being clear, while others crowd more faintly in, like dimly-seem objects which crowd in at the sides of the eye. Now it becomes concentrated, and only a few, or perhaps only a single idea is very vividly perceived if the powers of inward vision are acting with energy. And while, as a rule, sensations arrest the attention much more vividly than thoughts, this does not always hold. In some cases of mental diversion the most vivid sensations pass unperceived.

This phenomenon of concentrated vision, as applied to the mind, has very important consequences. For the mind is utterly inactive except when energized by consciousness, and only that portion of it is active which is so energized. And as the activity of the mind governs the movements of the body, it follows that our voluntary actions, of whatever kind, are controlled, not by the mind as a whole, but by that portion of it which is active. This undeniable principle produces certain strange and important consequences. Ordinarily a certain number of our ideas are active, and particularly those deep-lying and firmly-based mental impressions and hereditary mental conditions which, acting together, constitute what we call judgment, or common sense. But there are several normal and some abnormal states in which this condition is changed.

One of these is in the case of strong emotion. As an earnest desire fixes the eye intently upon some single object, and causes eye and mind alike to ignore what lies beyond this object, while all the movements of the body are in response to the desire; so

an energetic emotion fixes the eye of the mind upon some single thought, while all the remaining conditions of the mind fade and vanish from sight. In such a case judgment or reason no longer governs our actions, for the group of mental conditions which constitutes these faculties is dormant. In deep grief the person affected yields utterly to his sorrow, and cannot be aroused from his depression. In intense fear no powers of reason remain to control the movements. In violent anger only the idea of revenge upon the object of that anger may remain. The furious man is, in a certain sense, irresponsible. His mind is an arrow moved by a single string. It discharges itself upon the obnoxious object, for there is no controlling force to restrain it. It is only when the paroxysm of emotion has passed away, and consciousness again spreads its revealing vision over the broad field of the mind, that other mental conditions spring into action, and deep remorse may follow an impulsive deed which was committed while all the springs of reason were dried up by the consuming heat of passion. As to the question whether a person is morally responsible for acts committed in such a state, it can only be answered, that every person is under moral obligation to bring his emotions under the control of his reason. The habit of unchecked indulgence in emotion or passion may lead to as serious consequences as the formation of any other bad habit.

A second normal mode of mental concentration, utterly differing from the above, is that known as reverie. In this the consciousness is not fixed upon one thought. It wanders freely from thought to thought, and its partial concentration is a result of inactivity instead of emotional energy. The mind is closed against impressions from without, and is also closed against the great mass of its internal stores, from the simple inactivity of consciousness. The circulation becomes sluggish. The waste of brain tissue is decreased. Only a slight degree of nerve energy flows into the mind, and only a few of its countless store of ideas are aroused to activity. And the consciousness is not concentrated upon these. It flows freely over the links of association.

The dreaming state is merely an intensification of this state of revery. Now the circulation is reduced to its lowest point. Exterior impressions, except they be very violent or very unusual, fail to affect the mind. The inner store of ideas is alike inactive. In its extreme state this produces dreamless sleep. But in a less

extreme case the mind is partially active. Some oxygen visits the brain. The wasted nerve tissue is being reproduced. Conditions arise in which oxygenation feebly takes place, and the free energy of the nerve cell is given off. These conditions may arise under the influence of some impressions upon the nerves of sense, or under that of some intimate connection between a locality of the mind and a reorganized region of the brain. In either case a slight degree of energy flows into the mind, so slight that only a very limited field of thought becomes active. The results are very striking. These few active thoughts form our whole mental world. There is no force of exterior sensation or of interior judgment to control them. The most absurd conceptions seem to us to be actual facts. Its most vivid perceptions are in every case facts to the mind. Ordinarily these are sensations of outward objects. But where sensation is at rest the dominant idea assumes the appearance of an external reality. And where judgment is at rest the incongruity of an idea with actual facts may remain unperceived, though even in dreams absurdity becomes apparent, as though the judgment were partly aroused.

There are other characteristics of the mental organism which aid in assimilating it to physical organisms. It impresses us as if subject to variations of temperature. Its emotional states lead to the conception of hot or cold states, and the effects which they produce are very interesting. Thus fear or terror impresses us as a chill of the mental organism. And its effects are singularly like those of cold on the body. The latter when chilled becomes sluggish, dull, torpid, strongly predisposed to sleep. Intense fear in animals yields similar effects. They grow paralyzed, as it were, torpid or inactive in condition, and probably with dulled sensibility to pain and a general inactivity of consciousness. The condition of the seemingly charmed bird is probably of this character.[1] On the other hand passion is a state of heat. Its effect is to instigate excessive activity, violent movements, vivid consciousness.

[1] "Fear, alarm, terror, horror, in their major degrees at least, frequently paralyze all power of self-preservative action, creating a dangerous immobility of body, with an accompanying fixity of stare. This condition is often described as a kind of fascination, of which the main features are powerlessness of mind and body, with the gaze helplessly fixed on some dreaded object, generally some powerful enemy, such as a serpent. * * * In a minor degree fear may beget stupidity or mental confusion, leading to injudicious or useless action." Lindsay's Mind in the Lower Animals, II, 235.

Between the extreme states we have the condition of pleasure, in which the mind seems gently warmed, and of gloom or depression, in which it seems similarly chilled.[1] The reasoning power is most efficient in calm states, when the temperature is normal. Then consciousness is diffused and its vision extended. In the other conditions it becomes more concentrated, until, in extreme heat or chill, a single idea or feeling dominates the mind.

We have not space here to consider the more aberrant conditions of mentality, such as somnambulism, hypnotism, insanity, &c., and the various strange phenomena which attend injury to the brain. None of them are incongruous with the idea that the mind is a distinct organism, and the brain its instrument of activity. Nor can we consider the many interesting relations of thought to thought or memory to memory, and the interaction of memories which lie at the basis of the evolution of ideas. Many of these are highly interesting and peculiar, yet there is nothing in them inconsistent with the hypothesis we have advanced. It will suffice to say that no thought ever calls up another unless they are directly or indirectly related, or associated in time or place of reception. It may be said, however, that our ideas differ widely in their degree of fixity in the mind and influence over its movements. Below all, as the basis of the organism, lie a series of deeply-based hereditary conditions, gained during ages of mental development. These are very persistent, and strongly resist warping influences. And the effort to perform any action inconsistent with them is vigorously resisted, even though we may be very faintly conscious of the source of the resistance. The mental development obtained during youth is also deeply based, and actively resists the warping influence of later impressions. The later the impression in date of reception the less firmly does it seem implanted, as if these late impressions were but slight and superficial affections of the more deep-laid early stages of development.

[1] "In certain animals there is occasionally a perfect 'wildness of joy,' great intensity of mental excitement from pleasurable emotions. Thus Darwin speaks of the 'madness of delight' in a stickleback, meaning, no doubt, exhuberance of joy, or uncontrollable animal spirits." Ibid, II, 233.

Thus strong pleasure seems to produce general activity of mind and body, while deep grief or depression from any cause produces sluggishness and inactivity of consciousness, just the effects which would naturally flow from states of heat or chill in a physical organism.

In this connection a consideration of great importance and interest arises. It is certainly a singular fact that in the very exact transmission to the germ of minute features in the physical organization of the parent, the mental organization is never transmitted except in its basic characteristics. Every organ of the body is reproduced, with all its powers inherent. The cerebrum is reproduced and develops in company with the other organs. The fact that these organs are functionally copies of those of the parent proves that the reproduction is not only of material form but of the parental motor conditions. This equally applies to the cerebrum, whose motor conditions should fully reappear in its development. Yet if these motor conditions are the powers of the mind they certainly do not reappear. In every individual a new mind has to be built up. The body, cerebrum and all, may attain its full development and the mind remain in its germinal state. Evidently it is a constituent of the individual alone, and not a something that may be hereditarily transmitted. The character of the cerebrum limits and controls the extent and direction of the mental development, and imposes certain hereditary characteristics on its primary phases of unfoldment, but not a trace of the special mentality of the parents reappears in the child. This indicates that the mind is the property of the individual alone, in whose life it is developed, and whom it may survive. The whole physical frame, including the cerebrum, is represented in the germ, but the mental organism is never transmitted. This is certainly a fact of high significance.

The condition of emotion is one that seems analogous to conditions existing in every organism. It appears to be a state of heat or cold, strong passion, for instance, being an intensely heated state, and deep fear a state of shuddering chill. The mind has also its attractions and repulsions, and these seem to be closely concerned with its activities. Very many of our movements are directly due to drawings in some direction or towards some object, or repulsions from some object. The motives which govern our movements are very frequently motives of attraction or distaste, and with these motives some degree of the emotional state usually exists, a slight warmth in the case of attraction and a chill in the case of repulsion. Possibly some condition of these agencies is concerned in the changing relations of the mind to the brain, and may be the motor influence by which contact is effected,

energy set free and consciousness called into existence. In this connection attention may be called to Mr. J. S. Lambard's experiments on heat conditions during mental action. He found that emotion had far more influence than thought in this direction. A few minutes self-recitation of emotional poetry yielded more heat than several hours of deep thought. In the latter case the energy set free seems to have been employed in mind development. If the poetry was spoken less heat appeared. Here energy was used in muscle movement.

The considerations here taken in regard to the conditions of consciousness, and the relations of energy to the mental organism, seem to lead to the conclusion that every organized mass, when its internal relations become disturbed by the inflow of discordant external energies, must feel some influence more or less closely allied to consciousness. But if the vividness of consciousness in any sense depends upon the mobility of the organism, and the extent of the disturbance produced in its internal conditions, then it may pass through many degrees of unfoldment, from an excessively vague and generalized effect to the sharply specialized condition of human consciousness. In every case there is resistance to change. But in a rigid crystal the resistance is very great, while in a mobile mind it may be excessively slight, and disturbance of conditions be produced by influences of the utmost delicacy. It must be borne in mind, however, that in man consciousness accompanies action of energy on the mental organism only. Action upon the muscles, though yielding equal disturbance, is never attended by consciousness. Thus the peculiar conditions of substance which occur in the mental organism may be absolute requisites to this effect. It is also requisite to consciousness that the inflowing energies shall act only to modify the motor conditions of organization, not to produce disintegration, or to disseminate themselves as generalized motions.

With the lowest animals consciousness must be exceedingly vague and inactive. Their sensitiveness is undeveloped, their sense organs in embryo, the conditions to which they are exposed nearly unvarying. Most of their actions must be reflex. Yet some feeling of every new mode of impression must be experienced, and this feeling attends and perhaps aids in every step of upward evolution. The frequency and activity of consciousness

increases as we ascend in the animal scale. And what was once conscious condition falls steadily back into the realm of the unconscious, as higher stages of this activity arise. Yet even in lower man consciousness is dull in action and limited in range as compared with civilized man. Customary actions and thoughts tend to lose all sharpness of conscious definition, and the customary rules far more supremely in lower men and in the brute realm than in the world of civilization.

By this dulling of customary sensations consciousness is constantly set free for superior labors. It is actively exerted in getting a firm grasp on every new condition presented to it. But this once gained, attention is set free and reaches outward and upward. The new acquisition sinks deep into the mind, to be recalled at intervals, and perhaps in time to become a constituent part of the mental constitution. In the case of the child learning to walk, for instance, consciousness is vividly concentrated upon its efforts. But the movement once gained the attention is set free for devotion to other things, and the motion of walking may finally be performed unconsciously. Numerous other instances of this kind might be adduced, leading up to that often quoted and extraordinary one of the nearly or quite unconscious action of the fingers of the pianist.

In regard to mental labors the same rule applies. We are constantly exercised in observing new facts, imagining new conditions, forming new ideas. Each addition to our mental stores occupies the consciousness more or less exclusively until it becomes an habitual occupant of the mind, after which the attention is released for devotion to new labors, and the idea thus gained sinks back into the fabric of the mind. It may be recalled at will, but it no longer has a despotic control of the consciousness. In this upward progress of the mind we are often inclined to believe that the superiority of higher man is intellectual only, and that in regard to acuteness of the senses he has fallen behind the savage. Yet this is not the case. He may have lost acuteness in respect to distant vision, or sharpness of hearing, but his sensitiveness has grown far more diversified. He can see countless delicate shades of color and variations of form, can appreciate the most minute variations of musical tone, can distinguish delicate changes of odor and taste of which the savage is utterly incapable. His senses have thus become excessively more delicate and

varied in their powers, and his mind responsive to a greater variety of impressions.

It is in his ideas, however, that civilized man so greatly overtops the lower world of life. His mind has been for ages pushing deeper and deeper into the realm of the unknown like an eating sea that is cutting its way steadily into the land. Before it lies the unknown, stretching away into the infinite. Behind it lies the known, half or wholly buried beneath the shrouding waters of the sea. The surf line is the line of consciousness, the border between the known and the unknown. Here consciousness mines forever into the coast line of facts, letting every new-gained fact float out to come to rest on the quiet sea bottom, the stores of recent memory lying half visible in the shallow waters, while in the deep sea beyond lie the layers of ancient acquirement which have become to us hereditary capabilities, the native stuff of the mind. What new and deeper powers the senses may yet attain, what new susceptibility the mind, cannot be said. We see rising dimly and shapelessly around us new phenomena, new stuff for thought on which the mind of future man must work, and every new age may safely say to the ages of the past: "There are more things in heaven and earth, Horatio, than are dreamed of in your philosophy."

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A BRIEF BIOGRAPHY OF THE HALIBUT.

BY G. BROWN GOODE.

THE halibut, *Hippoglossus vulgaris*, is widely distributed through the North Atlantic and North Pacific, near the shores, in shallow water, as well as upon the off-shore banks and the edges of the continental slope down to the depth of at least 400 fathoms. The species has not been observed in the Western Atlantic south of the fortieth parallel; stragglers have occasionally been taken off Sandy Hook, Block island and Montauk point. It ranges north at least to Cumberland gulf, latitude 64°, to Holsteinborg bank in Davis' strait, and as far as Disko and Omenak fiord, latitude 71°, on the coast of Greenland, five or six degrees within the Arctic circle. It occurs along the entire west coast of Greenland, and is abundant about Iceland and at Spitzbergen, in latitude 80°. No one knows to what extent it ranges along the European and Asiatic shores

of the Arctic ocean, but it has been observed on both sides of the North cape, in East and West Denmark, and from the North cape, latitude 71°, south along the entire western line of the Scandinavian peninsula, in the Skager Rack and Cattegat, though not, so far as I can learn, in the Baltic sea. The halibut is occasionally seen in the southern part of the North sea and in the English channel, but never, in the Eastern Atlantic, south of latitude 50°. There is yet some question whether it is found in the south of Ireland, though some of the largest individuals recorded from Great Britain have been taken in the Irish sea, off the Isle of Man.

On the Pacific coast the halibut, which has been shown by Dr. Bean to be identical with that of the Atlantic, ranges from the Farallones islands northward to Bering straits, becoming more abundant northward. "Its center of abundance," says Bean, "is in the Gulf of Alaska, particularly about Kodiak, the Alexander archipelago and the Shumagins. Large halibut are numerous about the Seal islands, but the small ones have been killed by the seals. I have heard from good authority of their capture as far north as Saint Lawrence bay, near East cape, in Siberia. It has several times been reported from off the heads of Marcus bay, Siberia." It is occasionally taken off San Francisco and about Humboldt bay. In the Straits of Fuca and in the deeper channels about Puget sound it is taken in considerable numbers. A large halibut bank exists in the mouth of the Straits of Fuca, about nine miles from Cape Flattery in a north-westerly direction, and the capture of this fish is an important industry to the coast Indians.

The halibut is emphatically a cold-water species. That it should range nine or ten degrees farther south on the American than on the European coast, is quite in accordance with the general law of the distribution of fish-life in the Atlantic; indeed, it is only in winter that halibut are known to approach the shore to the south of Cape Cod, and it is safe to say that the temperature of the water in which they are at present most frequently taken is never, or rarely, higher than 45°, seldom above 35° and most often in the neighborhood of 32°. Its geographic range corresponds closely to that of the codfish, with which it is almost invariably associated, the cod is, however, less dependent upon the presence of very cold water, and in the Western Atlantic is found

four or five degrees—in the Eastern Atlantic at least two—nearer the equator, while the range of the two species to the north is probably, though not certainly, known to be limited relatively in about the same degree. In the same manner the halibut appears to extend its wanderings further out to sea, and to deeper and colder waters than the cod. Although observations on this point have necessarily been imperfect, it seems to be the fact that cod are very rarely found upon the edge of the continental slope of North America beyond the 250-fathom line, while halibut are present in abundance upon the outer slope.

The name of this fish is very uniform in the regions where it is known, though, of course, subject to certain variations in the languages of the different countries, for its characteristic features are so unmistakable that it is rarely confounded with other species. The only fish for which it is mistaken seems to be the turbot of the European coast, with which it sometimes interchanges names. It is said that in Scotland the halibut is frequently called the turbot, and Yarrell has expressed the opinion that in instances where it has been claimed that halibut had been taken in the south of Ireland the turbot was the species actually referred to.

"Halibut" and "holibut" are words which are as old as the English language. In Germany the fish is called "heilbutt" or "heiligebutt;" in Sweden, "hällefisk" or "hälleflundra," while in Holland it is known as the "heilbot."

In studying these names it should be borne in mind that "but" or "bott" is only another word for flounder or flat fish, and that the English, Dutch, German and Scandinavian prefixes to this word or the equivalent word flounder are presumably of the same meaning. A false derivation has been imagined for the name, which is exemplified in the German word "heiligebutt" just mentioned, and also in an English spelling, which is sometimes encountered, "holybut." This idea is without foundation, for the halibut has never been reverenced more highly than any other species of flat fish, and the derivation is as fanciful as "haul-a-boat," which our New England fishermen have frequently assured me was the proper name, having reference to the size and strength of the fish. The true derivation of the word may best be understood through a study of its Scandinavian names, from which it appears that the prefix has reference to the holes or deep

places at sea in which the fish is found, and that the name simply means "a deep-sea fish," or "a deep-sea flounder."

The general distribution of the halibut having been sketched in outline, it may, perhaps, be appropriate to discuss more fully the range and abundance of the fish upon the coast of North America, and to describe the regions where it is sought by American fishing vessels.

Halibut are taken very abundantly on Holsteinborg bank, at the southern entrance to Davis' strait, latitude 67° north and longitude 54° to 56° west, where several Gloucester schooners have in past years obtained large cargoes of salted fish. In Etzel's "Grönland," it is stated that halibut are taken chiefly in the southern part of North Greenland, and everywhere on the shoals among the islands in the district of Egedesminde, especially about Agto, Riskol and Ikerasak, in latitude 68°, and somewhat less near Disko, in latitude 76°. They are captured most abundantly in the spring and fall. They are even taken, at greater depths, as far north as Omenak, in latitude 71°. In a later work Rink asserts that "the Netarnak or larger halibut is found on the banks, as well as in different places outside the islands, up to 70° north latitude, in depths of from thirty to fifty fathoms." In the same later work Rink remarks that halibut are plentiful in the fall about Egedesminde, and especially about Agto, the southernmost outpost of North Greenland. Etzel goes on to state, regarding the occurrence of halibut in South Greenland, that in July and August they are taken on the outer coast and among the islands at depths of thirty to fifty fathoms, while in winter they frequent deeper regions and are but seldom seen. Rink narrates that in 1809 there were taken among the islands off Godthaab (64° 8′ north latitude) 2000 halibut, and that in a single half-day two boats took over one hundred. They are rarely taken in the district of Julianshaab, in latitude 60° 43′ north.

Peter C. Sutherland, writing of Riskol bank, in 1850, stated that halibut were then very abundant in that locality, and that the cod-fishing vessels which visited Davis' strait every season used them to bait their hooks, though the supply far exceeded the demand for this purpose.

Sutherland narrates that on the return of the Penny expedition, in 1851, when crossing the Arctic circle, in longitude 53°, the sailors put over lines baited with pork and hooked a cod and a halibut at the depth of forty fathoms.

The most northern occurrence of the halibut on the western side of Davis' strait is that recorded by Mr. Ludwig Kumlien, naturalist of the Howgate expedition, who saw a large individual taken by the Eskimos off the mouth of Davis' straits, near latitude 64° north.

Richardson, in the Fauna Boreali-Americana, speaks of the occurrence of the species on the Greenland coast, but seems to have no authentic information of its having been observed even as far north as Labrador on the opposite side.

There is no reasonable doubt that the halibut is found along the entire eastern coast of Labrador, though there is no other published record of its occurrence north of Red bay, in the Straits of Belle Isle, near latitude 51° 40′ north, where it was observed by Mr. Horatio R. Storer, several individuals having been taken during his stay at that place in the summer of 1849.

It is abundant in certain parts of the Gulf of St. Lawrence, especially the island of Anticosti, and is also found along the entire coasts of Newfoundland and the eastern shores of Nova Scotia.

In June, 1878, the schooner *G. P. Whitman*, of Gloucester, caught a fare of halibut in two to twelve fathoms of water near Green point, Newfoundland. The crew said that they could see the fish lying on the bottom in shallow water.

Capt. George Olsen, schooner *Proctor Brothers*, arrived at Gloucester, August 2, 1880, with 22,000 pounds' weight of fresh halibut from Anticosti. He reported halibut plenty then at the western end of the island close inshore—within half a mile; he saw the halibut sporting near and on the surface; he found they would not bite, as on the banks, at halibut bait, and since fresh herring or capelin could not be obtained, could only get a partial trip of halibut. They were good fish, weighing sixty to eighty pounds.

According to M. H. Perley halibut are found in the Bay of Fundy up to its very head, where they are taken in summer in Cumberland bay, near the light-house off Apple river, and also in West bay. He states that they are also found on the south shore of the Bay of Fundy, and abundantly from Cape Split to Brier island, as well as in the Annapolis basin. Perley's report was prepared in 1852, and there is no evidence of diminution in that region since he wrote.

Mr. J. Matthew Jones tells me that halibut are occasionally

taken at Five islands in the Basin of Minas, but that this is of rare occurrence.

I am indebted to Captain Ashby for the following facts about the southern limits of the distribution of the halibut: He has never known them to be found south of Sandy Hook, where large ones are occasionally taken in winter. In May, 1876, the schooner *Cartwright*, fishing ten miles south-east of Montauk point, caught many halibut. In February, 1876, some Noank smacks caught a few halibut about eight miles from land, off the south-east point of Block island. Within the last forty years one or two halibut have been taken off the outer shore of Fisher's island. He has never known any to be taken in Long Island sound. Halibut are sometimes taken in three fathoms of water among the breakers off Nantucket, in "blowy weather." Forty years ago they were abundant about Gay head and Noman's land. There has been no systematic fishing there lately, but some individuals have probably been taken.

The local papers chronicled the capture, on May 1, 1876, off Watch hill, Rhode Island, of an eighty-pound halibut, the first taken in that locality for many years.

A halibut is occasionally taken along the shores of Maine and Massachusetts, but so seldom that a capture of this kind by one of the inshore fishermen is always mentioned in the local papers.

Abundance.—Half a century ago the halibut was extremely abundant in Massachusetts bay, and striking stories of their great plenty and voracity are narrated by some of the early fishermen of Cape Ann. Of late years, however, few have been found except in deep water on the off-shore banks.

Captain Chester Marr says that in early days halibut were exceedingly abundant on George's bank. He has seen a "solid school of them as thick as a school of porpoises" feeding on "lant." At another time "the whole surface of the water as far as you could see was alive with halibut; we fished all night and we did not catch a single codfish. The halibut would not let the hook touch the bottom; we caught 250 in three hours; the crews of some vessels would go and cut the fins off the fish and let their bodies go. No wonder that they were broken up. We thought they were always going to be so. Never made no calculations that we were going to break them up. The southern

side of George's was a kind of 'mother-place' for fishing halibut." There was no great abundance of halibut on George's after 1848.

The abundance of the species on the off-shore banks before the over-fishing took place is almost beyond credence. The following is selected from a large number of instances of fishermen's successes: The schooner *Mary Carlisle*, of Gloucester, made nine trips to the banks in 1871. Her catch was 350,188 pounds of halibut and 58,759 pounds of codfish; her net stock amounted to $17,275.53 for about eleven months' work, from December 27, 1870, to November 21, 1871. On one trip in the spring she brought in 58,553 pounds of halibut and 6900 pounds of codfish, her net stock reaching the sum of $4738.75, and her crew sharing $236.25 each from a voyage of thirty-four days. She had ten men in her crew, each of whom during the season shared $858.62. In three years this vessel stocked a total of $46,871, divided as follows: 1869, $17,549; 1870, $12,047; 1871, $17,275.53.

The presence of so important a food-fish in America did not long escape the observations of the early English explorers. Captain John Smith, in his History of Virginia, wrote: "There is a large sized fish called hallibut, or turbut: some are taken so bigg that two men have much a doe to hall them into the boate; but there is such plenty, that the fisher men onely eat the heads & finnes, and throw away the bodies: such in Paris would yeeld 5. or 6. crownes a peece: and this is no discommodity."

The halibut is surpassed in size by only three fishes on the Atlantic coast—the swordfish, the tunny and the tarpum. It is said, by experienced fishermen, that there is a difference in the size of the two sexes, the females being much the larger; the male, they tell us, rarely exceeds fifty pounds in weight, and is ordinarily in poor condition and less desirable for food. The average size of a full-grown female is somewhere between 100 and 150 pounds, though they are sometimes much heavier. Captain Collins, who has had many years' experience in the Gloucester halibut fishery, assures me that he has never seen one which would weigh over 250 pounds, and that a fish weighing over 250 pounds is considered large. There are, however, well authenticated instances of their attaining greater dimensions. Captain Atwood, in a communication to the Boston Society of Natural

History in 1864, stated that the largest he had ever taken weighed, when dressed, 237 pounds, and would probably have registered 300 pounds when taken from the water. In July, 1879, the same reliable observer saw, at Provincetown, two individuals taken near Race point, one of which weighed 359 pounds (302 pounds when dressed), the other 401 pounds (322 pounds when dressed).

There is a tradition in Boston that Mr. Anthony Holbrook, one of the early fish-dealers of that city, had in his possession a halibut, taken at New Ledge, sixty miles south-east of Portland, which weighed over 600 pounds. This story, which is recorded by Storer in his "Fishes of Massachusetts," Captain Atwood believes to be untrue. Halibut weighing from three to four hundred pounds, though unusual in comparison with the ordinary size, are by no means rare. I have before me records of ten or twelve such fish captured on the New England coast during the past ten years. Nilsson, has mentioned the capture, on the Swedish coast, of an individual which weighed 720 pounds. There are stories of halibut ten feet in length; a fish weighing 350 pounds is between seven and eight feet long and nearly four feet in width. The largest halibut are not considered nearly so good for table use as those of less than 100 pounds weight. A fat female of eighty pounds is, by good judges, considered to be in the highest state of perfection, while males are not so highly esteemed. Small halibut, known as "chicken halibut," ranging from ten to twenty pounds, are much sought after by epicures, and bring a high price in the New York and Boston markets. They are, however, comparatively rare, and those weighing ten pounds or less are rarely seen; the smallest recorded from our coast was about five inches in length, and was taken by Professor Verrill in a dredge-net in the Strait of Canso.

The halibut of the Pacific are apparently similar in dimensions to those of New England. Mr. Anderson, inspector of fisheries for British Columbia, states that in the waters of Puget sound they attain a weight of 200 pounds.

The wholesale dealers of Gloucester, in buying fresh halibut from the fishermen, recognize two grades; one, which they call "gray halibut," they consider to be of inferior value, and pay a lower price for. The gray halibut are distinguished by dark cloudings or blotches upon the under side, which in the most

marketable fishes are pure white. Almost all the largest halibut are classed among the grays. Fishermen claim that there is no actual difference between the gray and white fish, and it is a fair question whether they may not be right.

Migrations.—It is useless to attempt to describe at this time the migrations of the halibut from place to place; although much information has been received upon this subject, the problem requires long and careful study.

Captain Benjamin Ashby, of Noank, Connecticut, who is familiar with the fisheries south of Cape Cod, informs me that halibut frequent the deepest water in the spring and fall, and that in May and June they come up in the shoal water, in sixty or seventy fathoms, while in July they begin to go out again into deep water, and by the latter part of the month are on the way into the gully near the north-east part of George's bank.

Captain Joseph W. Collins, undoubtedly the best authority upon the subject, briefly expresses his views as follows; "Halibut are found in the deep water—say from 100 to 250 fathoms in depth—on the edge of all the banks from George's to the Grand bank the year round. Sometimes, however, they seem to be more numerous in comparatively shallow water in the winter and early spring. This was the case in the winters and springs of 1875–'76 and 1876–'77, as well as in the year preceding, but in 1878 there was no great catch of halibut in less than 100 fathoms on any of the banks. The great schools that were found in the western part of the Grand bank in February and March, 1876 and 1877, appeared to be migrating. The fish that were found to the south of latitude 44° north were mostly small-sized white halibut. They went off the bank into deep water, and nobody knew what became of them. Those that were caught to the north of this parallel were mostly large gray fish, and were traced as far as Saint Peter's bank. These are possibly the same fish—they are certainly the same kind of fish—that struck in on the western coast of Newfoundland and in the summer months in pursuit of capelin."

Capt. George A. Johnson states that the large halibut generally frequent the outer and deeper part of the banks, while the little "bull fish" lie inside, on shallower ground, and are caught on the inner end of the trawl lines; sometimes, however, the large halibut also come up on the shallow grounds.

On the coast of Newfoundland, Anticosti and Labrador, in summer, halibut frequently run inshore after capelin. When in shallow water near the shore they are usually wild and very active. Within eight years the fishermen have extended their fishing much farther out to sea; previous to that time the greater part of the halibut were taken on top of the Grand bank in thirty to fifty fathoms of water, but after the beginning of April the fish went elsewhere, and the fishermen lost sight of them. They soon learned, however, to follow them down the slopes of the banks, though before 1876 they had rarely fished in water deeper than seventy to ninety fathoms. Since that time, as has already been stated, fishing has been carried into twice or three times that depth. All that can at present be said in explanation of their movements is, that they occur in great schools, which consume the available food in any one locality, and are soon obliged to shift their position to some other place where they can find fresh supplies. It does not seem possible that their migrations can be caused by conditions of temperature or are in connection with their breeding habits. During the breeding season the schools sometimes remain for months in one locality, and these places are generally of limited extent. While spawning but little if any food is found in their stomachs.

Food.—They are large-mouthed, sharp-toothed and voracious, and though especially adapted for life upon the bottom, doubtless feed largely upon crabs and mollusks. They are especially fond of fish of all kinds; these they waylay, lying upon the bottom, invisible by reason of their flat bodies, colored to correspond with the general color of the sand or mud upon which they rest. When in pursuit of their prey they are active, and often come quite to the surface, especially when in the summer they follow the capelin to the shoal water near the land. They feed upon skates, cod, haddock, menhaden, mackerel, herring, lobsters, flounders, sculpins, grenadiers, turbot, Norway haddock and bank clams. Captain Ashby tells me that common flounders and flat fish are among their most favorite food; these they follow upon the shoals of George's and Nantucket, lying in wait for them on the sand-rips and seizing them as they swim over. He has seen half a bushel of flat fish stowed away tightly in the stomach of a single halibut. He has often seen halibut chasing flat fish over the surface of the water. About Cape Sable their

favorite food seems to be haddock and cusk. He has seen eight or ten pounds of haddock and cod taken out of one of them. When they are on the shoals they are sometimes filled with flat fish, haddock, cusk, sculpin and herring, but when in deep water he has found very little food in them. They eat crabs and other crustaceans, but shells are rarely found in their stomachs, except those of clams and mussels.

Captain Hurlbert tells me that when the vessels are dressing codfish on the Grand banks, and the backbones and head are thrown overboard, these are frequently found in the stomachs of halibut taken in the same locality.

Mr. William H. Wonson, of Gloucester, has seen live lobsters six inches long taken from the stomach of a halibut. Captain Mar states that they feed on whiting, mackerel and herring. He remarks: "Halibut will drive off any kind of fish and take charge of the ground."

At the meeting of the Boston Society of Natural History, in 1852, Dr. W. O. Ayres stated that he had seen a block of wood, a cubic foot in dimensions, taken from the stomach of a halibut, where it had apparently lain for a long time. Capt. George A. Johnson found an accordeon key in one of them. Olafson, in 1831, studying them on the coast of Greenland, found not only pieces of iron and wood in their stomachs, but in one individual a large piece of floe ice. Captain Collins has observed that they often kill their prey by blows of the tail, a fact which is very novel and interesting. He described to me an incident which occurred on a voyage home from Sable island in 1877: "The man at the wheel sang out that he saw a halibut flapping its tail about a quarter of a mile off our starboard quarter. I looked through the spy-glass and his statement was soon verified by the second appearance of the tail. We hove out our dory and two men went in her, taking with them a pair of gaff-hooks. They soon returned bringing not only the halibut, which was a fine one of about seventy pounds weight, but a small codfish which it had been trying to kill by striking it with its tail. The codfish was quite exhausted by the repeated blows, and did not attempt to escape after its enemy had been captured. The halibut was so completely engaged in the pursuit of the codfish that it paid no attention to the dory, and was easily captured."

The observations of the halibut fishermen are full of interest

to the naturalist, and it is from them that we derive all our knowledge of the habits of the animal while feeding. The halibut, following in after the schools of capelin which visit the shores of Western Newfoundland, Southern Labrador and the islands of Anticosti and Miquelon to spawn, have often been found in great abundance in very shallow water, not above five to ten fathoms deep.

Fishermen who have watched halibut under such circumstances, and have been able to see them perfectly well in the clear water, state that these fish exhibit marked peculiarities in biting at baited hooks on a trawl. The halibut will advance to the bait, apparently smell of it, and then retreat four or five feet from it, always lying on the bottom, head toward the bait, as if watching it. After repeating this performance several times—generally three or four—the fish seems to make up its mind to eat the bait, and suddenly darting toward it, swallows it down with a gulp.

The George's hand-line fishermen believe that halibut often strike the baited hooks with their tails. It is not uncommon on board a George'sman to hear a fisherman remark: "There's a halibut around; I felt him strike my gear." When a halibut has announced his presence in this way it is scarcely necessary to say that every effort is put forth by the fisherman to attract the fish to his hooks, and if a man is sufficiently skillful he generally succeeds in capturing the fish.

There is much rivalry in a vessel's crew when it is known that halibut are on the ground where she is lying, and every known device is adopted to entice the fish to bite at the hooks. Strips of newly-caught haddock, with fresh blood still on them, are considered the best bait. Two, three, or more of these are put on a hook, which is passed through the thickest end of the strips, while the pointed ends of the bait are left to float about in the water. Where there is a tide running these closely resemble the movements of a small fish. The hooks are usually "pointed" with herring bait. After the bait is on the hooks many fishermen add (as they believe) to its attractiveness by mopping it in the slime of a halibut, if one has been previously caught. This is done by wiping the baited hook back and forth over a halibut. The lure thus prepared, the fisherman lowers his apparatus to the bottom, and by a skillful manipulation tries to induce the fish to bite. Sometimes he will let the tide sweep his "gear" along the bot-

tom, and again he will endeavor to give his baits the appearance of life by slowly pulling them up a short distance from the ground. If he finally succeeds in hooking a halibut, all his art is required to bring the fish to the surface and land it safely on deck. If it be a large fish it almost invariably makes a desperate fight to escape. It may, perhaps, come up easily for ten or fifteen fathoms, when it suddenly takes a plunge downward. Surge! surge! goes the line through the hands of the fisherman, who knows very well that he must "play" his fish or else his line will be snapped like pack thread. This operation may be repeated several times, and it is not uncommon for a large and particularly "wild" halibut to go almost to the bottom after having been hauled nearly to the surface of the water. At last the fish is alongside, and the shout of "Gaffs! gaffs here!" brings two or three of the nearest men to the side, armed with long-handled gaffs. If the fish is exhausted the gaffs are quickly hooked into his head and he is dragged unceremoniously over the rail and falls with a heavy thump on deck, which usually resounds with the strokes of his powerful tail until he is stunned by repeated blows with a killer. If the halibut is still active when he comes alongside, much dexterity is required to gaff him. He makes desperate attempts to escape, and thrashes the water into foam with his tail.

When the fish is on deck and killed, his captor cuts his mark in a conspicuous manner, generally on the white surface of the halibut, which is the underneath portion when the fish is in the water, but is invariably turned upward after it is taken on deck; this method being adopted to prevent the blood from settling on that side and thus making the fish look dark colored or gray. The George's fishermen frequently bleed their halibut by making a cut across the tail.

Halibut caught in shallow water are exceedingly active, and frequently make a hard fight. When a fish of 100 to 200 pounds weight is raised from the bottom on a trawl, he usually starts off at great speed, making the dory spin around in his effort to escape. Of course he cannot run far in one direction, for the weight of the gear is too much for him to drag over the bottom. After a while he is sufficiently tired out to be hauled alongside of the dory, and if the fisherman is expert enough to hit his fish two or three smart raps over the nose with a "killer," the halibut

succumbs and is pulled into the boat. It is often the case, however, that considerable difficulty is experienced in effecting the capture of a large fish, and it is by no means an unusual circumstance for one to escape.

A fisherman related to me an incident which he witnessed in the shallow water near Miquelon beach, Newfoundland. Two men were out hauling a trawl in about seven fathoms of water, a short distance from the vessel. They worked along quietly for a while, when suddenly the dory started off at a tremendous speed, towed by a big halibut which had been started from the bottom, and which, in its efforts to escape, darted about wildly, pulling the boat after it and careening her at a considerable angle. By dexterous management it was, after a while, brought to the surface; the man aft quietly pulled up on the ganging until the fish broke water, when an iron gaff was driven into its head. The doryman had made the mistake of gaffing his fish before it was stunned, and as a result, no sooner was the gaff in the halibut than the latter made a tremendous splurge, twisted the implement out of the fisherman's hand, and, getting a fair start, made a run to the bottom. Another quarter of an hour was required to again get it alongside of the dory. This time there was no gaff, and to serve in its place the doryman had cast off the trawl anchor from the buoy-line. When he got the halibut's head above water he drove the fluke of the sixteen-pound anchor into the fish, which he made sure he would hold that time. But he was mistaken. The halibut, as before, escaped, taking with it the anchor, almost pulling the man out of the boat, which was nearly capsized, and going off with the hook, too, which this time it tore from the trawl.

The halibut, in its turn, is the prey of seals, of the white whale and of the various large sharks, especially the ground shark, or sleeping shark, in the stomachs of which they have sometimes been found; their sides, I am told by Captain Collins, are often deeply scarred, probably by the teeth of the sharks, or in their early lives by mouths of larger individuals of their own kind.

Spawning.—There is great diversity of opinion regarding their spawning season. Some fishermen say that they spawn at Christmas time, in the month of January, when they are on the shoals. Others declare that it is in summer, at the end of June. Capt. George A. Johnson, of the schooner *Augusta H. Johnson*, of

Gloucester, assures me that halibut "spawn, just like the human race, at any time of the year." In April, 1878, he was fishing on Quereau bank and found large and small halibut, the large ones full of spawn. In May he was on Le Have bank, where he found only small male fish full of milt; in June he was on Le Have again, fishing in shallow water, where he found plenty of "small bull fish, with their pockets full of milt;" in July he was again on Quereau bank, where he found a school of small and big male and female fish, all apparently spawning or ready to spawn, "with milt and pees soft;" in August he was on the outer part of Sable island, where he found females full of spawn.

Captain Ashby, speaking of the halibut on George's banks, states that roe is always found in them in May and June. The roes of a large halibut caught by him in 1848 on the south-west part of George's, and which weighed 356 pounds, after it had been dressed and its head removed, weighed 44 pounds. He states that the halibut in this region have spawn in them as late as Connecticut vessels continue to catch them, or until September. He has seen eggs in halibut of twenty pounds weight, and thinks they begin to breed at that size. The spawn of the halibut is a favorite food of the fishermen of Southern New England, though never eaten by those of Cape Ann.

Captain Hurlbert, of Gloucester, tells me that on the Grand banks of Newfoundland the spawning halibut school used to come up in shoal water in forty or fifty fathoms. In August, 1878, he found many with the spawn already run out. At that time several Gloucester fishermen reported that the halibut on Le Have and Quereau banks were full of spawn. Captain Collins told me that in July and August, and up to the first of September, they are found here with the ovaries very large, and are often seen with the ova and milt exuding. The ovaries of a large fish are too heavy to be lifted by a man without considerable exertion, being often two feet or more in length. At this time very little food is found in their stomachs. In September, 1878, the Fish Commission obtained from Captain Collins the roes of a fish weighing from 190 to 200 pounds, taken by the schooner *Marion* on the 13th of the month on Quereau bank. This fish was taken at the depth of 200 fathoms, and the temperature of the water was roughly recorded at 36° F. These ovaries were put into a basket with ice and brought to the laboratory of the Fish Com-

mission, where they were found to weigh seventeen pounds two ounces. Part of the eggs were nearly ripe, and separated readily, while others were immature and closely adherent to each other. A portion of the roe, representing a fair average of the size of the eggs, was weighed, and was found to contain 2185 eggs; the weight of this portion was two drams. The total number of eggs was from this estimated to be 2,182,773. It is not yet known whether the eggs float or rest upon the bottom, nor is it known how long is the period of incubation, nor what is the rate of growth of the fish. As has already been mentioned, young fish are very unusual; the smallest ever seen by Captain Ashby in Southern New England was taken on Nantucket shoals, and weighed two and a half pounds after it had been eviscerated.

Abnormal individuals.—"Left-handed halibut" are sometimes taken. Perhaps one out of five thousand is thus abnormal in its form, having the eyes upon the left rather than upon the right hand side of the head.

Halibut with dark spots or patches on the under side, of the same dark color as the back, are occasionally taken. These are called by the fishermen "circus halibut." They are generally of medium size and thick, well-fed fish.

The history of the halibut fishery has been a peculiar one. At the beginning of the present century these fish were exceedingly abundant in Massachusetts bay. From 1830 to 1850, and even later, they were extremely abundant on George's banks; since 1850 they have partially disappeared from this region; the fishermen have recently been following them to other banks, and since 1874 out into deeper and deeper water, and the fisheries are now carried on almost exclusively in the gullies between the off-shore banks and on the outer edges of the banks in water 100 to 350 fathoms in depth. The species has in like manner been driven from the shallow fishing grounds on the coast of Europe; there is, however, little reason to doubt that they still are present in immense numbers within easy access off the British and Scandinavian coasts, and that a good fishery will yet grow up when the fishermen of those countries shall have become more enterprising.

A Prophecy.—In the year 1879 there were forty vessels, of 3168 tons, from Gloucester, Mass., employed exclusively in the fresh-halibut fishery; also vessels hailing from New London and the eastern end of Long island are employed, except during the

winter months, chiefly in the capture of halibut, which they carry to New York. These vessels, however, take also a considerable quantity of codfish. In addition to the Gloucester vessels already mentioned, which fish for halibut throughout the year, there were eight vessels, of 647 tons, which fished for halibut in the winter season and engaged in other fisheries, generally the cod fishery, from May to November.

The vessels of the George's fleet, though their chief object is the capture of cod, take considerable quantities of halibut, which are brought to Gloucester fresh; a few also are sometimes taken by the Western bank cod fleet, and a still smaller quantity by the Boston market fleet. In 1879, and probably in 1880, there were a few small vessels on the coast of Maine which engaged in the fresh-halibut fishery for three or four months in the summer, carrying their fish chiefly to Portland. The total catch of halibut on the New England coast for 1879 is estimated at 14,637,000 pounds, distributed as follows:

Gloucester halibut fishery	8,300,000
Gloucester vessels fishing in winter only	1,000,000
New York halibut catchers	3,000,000
Gloucester, George's fleet (incidental)	2,000,000
Western bank cod vessels (incidental)	37,000
Small vessels on the coast of Maine and Massachusetts	300,000
Total	14,637,000

In 1885 the halibut fleet of Gloucester is reduced to one-fourth of its former size, and the total catch is estimated at from three to five million pounds.

It is evident that within a few years the American off-shore halibut grounds will be so depleted that the fresh-halibut fishery on our coasts will be abandoned. We shall then derive our chief supply from the waters of Greenland and Iceland, where several vessels go each year to bring back cargoes of salt "flitches." Halibut will come into our markets only in a smoked condition, and the species will be as unfamiliar in our fish-markets as it is in those of the old world. The life-history of the species must be recorded now, for it can never be made so completely hereafter. This is the writer's excuse for having presented in this place so full a biography of the halibut.

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TRACES OF PREHISTORIC MAN ON THE WABASH.

BY JOHN. T. CAMPBELL.

DURING the year 1884 I was employed as civil engineer for the construction of a levee from the mouth of Big Raccoon creek on the east side of the Wabash river, which is the west boundary of Parke county, Indiana. The levee was built as close to the river bank as practicable, and was aimed to be the height

of the highest bottom land, though this is about seven feet below the highest floods, such as occurred in the summer of 1875 and winter of 1883. There is one very high bottom about four and a half miles south of the mouth of Raccoon creek, locally known as Blue Grass landing. Forty to fifty years ago this place was well known to flat and steamboat men. The Wabash was then the great commercial thoroughfare for all this country, and this being a good landing, backed by good farms near by, and covered with the heavy, green carpet of blue grass (*Poa pratensis*), was also one of the most beautiful spots on the river. Here it was, according to Dr. Collett, State geologist, report of 1879, that the Kentucky soldiers of Harrison's army, while marching from Fort Harrison to Tippecanoe to fight the Indians there, found the original Kentucky blue grass, and on their return gathered and carried home the seed, which is now an important article of Kentucky commerce.

The old settlers had a tradition that this spot (a quarter of a mile long up and down the river) was an ancient Indian camping ground. What reasons they had for so believing I never learned. But during my frequent surveys and inspections of the work before mentioned, I had abundant reason to know that such was the fact. The surface of the ground, however, indicates nothing of the kind. The place is not overflowed more than once in seven years on the average. The bottoms are over a mile wide, and much the lowest back next the hills. The few floods that have overflowed this high bank during recent years (I mean historically recent, not geologically) have flowed nearly square across it, and since the timber has been cut away, has washed small channels from four to ten feet deep toward the eastern hills. These channels are deepest next to the river, growing shallower till they disappear at distances from one-quarter to three-quarters of a mile from the river. In the bottom of these channels Mr. Samuel D. Hill, drainage commissioner of the county, was the first to observe little heaps composed of stones about the size of apples or potatoes, and about a bushel in quantity. They were in the more recently cut channels, the current being sufficient to remove the bottom earth but not enough to disturb the order of the stones. I said the stones were in heaps; this is not quite correct. They were about three layers deep and two and a half to three and a half feet wide, and slightly oval in shape. They were

underlaid with one to three inches of charcoal, and on top of the stones, and scattered down streamward from them, were mussel shells and a few bones of small animals too much decayed and fractured to be identified; but the leg of a crane or pelican near by was so well preserved that every joint of the foot to the nail was in perfect shape. But on handling it soon crumbled into lime dust. So it was with the mussel shells, except a half shell, which was as fresh as if taken recently. The stones were such as lie at the upper end of the river bars, mostly crystalline, some gray, others blue. All had originally been smooth, water-worn, but were broken into angular fragments, segments, cubes and zones. I put the pieces together in several instances and with them completed (filled out) smooth, rounded water-worn stones. All had a dark smoky look as if having been burned in the fire. I should think that those we examined and those we saw without special examination would amount to seven cubic yards. One piece of white limestone, about the size and much the shape of a brick, when I touched it I found to be slaked into lime.

The charcoal underneath the layers of stones on the coal, their smoky appearance, their peculiar fractures, all show that they had been placed on a fire. The mussel shells and bones on and near these stones indicate that the purpose of that fire was for cooking. It is very difficult to open the shells of a live mussel (Wabash oyster), but when baked on hot rocks they easily yield.

I say these stones were found in heaps. Such was true of five separate piles or heaps, from which I infer that all the stones found in the largest and oldest channel had been once so piled, as they were smoked and broken in the same way, and seemed to amount in quantity to ten wagon loads or about seven cubic yards.

When were these stones piled and used as above described? "That is the question." This place or piece of bottom is very seldom overflowed now, consequently it is building up from sedimentation very slowly. The heaps, or piles of stones were found about five feet beneath the present surface, and on the present surface bur oak trees are standing that are two hundred and fifty years old. These grew from acorns borne by a previous generation of trees, and the acorns from which they grew, judged by the surface roots of the trees, were not more than two feet beneath the present surface of the ground. The under side of the surface roots would be a little below the position of the acorn when the

tree started. It is my judgment that not less than five hundred years have elapsed since these stones were covered by sedimentation, and I should think the time would not exceed one thousand.

As stone axes, knives and arrow-heads were searched for among these stones and not found, I think they were not used by the people who used the stones for cooking. Among so many stones of that kind, and in a camp, some tool would have been dropped. Such tools are found on the present surface in every neighborhood about here. If this should prove correct (that none were used by this people), it would prove that the stone axe is not so old as we have heretofore thought it to be. Or, did these people take extra care of their tools? Then why did the much later Indians having equal use for *their* tools, drop them all over the country? Or, were these suddenly abandoned on the introduction of steel tomahawks, knives and fire arms?

There are no Indian mounds within fifty miles of this camp. It was, therefore, hardly the work of the mound-builders. My ancestors for three generations were pioneers, and well acquainted with Indian character and customs from 1760 to 1820, and from Massachusetts to the Wabash, and while I have heard very many of their Indian stories I have never heard of their seeing anything like what I have described, nor do I remember to have seen it described in any account I ever read. Is this a new feature of an ancient subject? or am I illy informed on it?

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EDITORS' TABLE.

EDITORS: A. S. PACKARD AND E. D. COPE.

——The session of the American Association for the Advancement of Science for 1885 has just adjourned its session at Ann Arbor, Michigan. The meeting presented many admirable features. Other things being equal, a university town has superior advantages for the conduct of scientific gatherings. The spirit of the place is congenial. Facilities for presentation and illustration are at hand. The university buildings furnish excellent assembly rooms. The social conditions are appropriate and not distracting. Such were the circumstances which attended the late meeting, and the members experienced their benefits to the full. The number of members in attendance (510) though smaller

than at many previous meetings, may be safely asserted to have embraced a larger percentage of the scientific element than they. Although the number of papers read (175) was smaller than at some preceding meetings, the quality, in many of the sections at least, was exceedingly good. If it were possible we should prefer that the American Association might always meet beneath the shadow of a university, and in a town like Ann Arbor, whose *raison d'etre* consists of the university which it contains. But such towns are rare in the United States, and we cannot expect to be always surrounded by the favorable conditions of the meeting which has just closed its sessions.

—— The controversy over the question whether the human embryo has a genuine tail like that of the embryo of other mammals, has been nearly set at rest by the painstaking researches of Professor Fol, of Geneva.

We have translated his article from the reprint in the *Journal de Micrographie* for June, and the reader may for himself see how this skilled histologist has proved the presence for a short period in embryos in the fifth and sixth week of their development, of four embryonic vertebræ, which after the sixth week fuse together; the tail itself at first elongated and regularly conical, becoming shorter and more rudimentary. Professor Fol, in closing, simply contents himself with remarking that the embryo human tail well deserves the name, and that the organ "evidently deprived of all physiological utility, should be classed in the number of representative organs."

This temporary, deciduous organ, which appears for only a brief period and still comparatively early in embryonic life, points unmistakably to the origin of man from some tailed mammal, whether a monkey, or some less specialized form, possibly allied to that generalized type, the lemur.

This instance is one of several others in the growth and structure of the human body which affords so strong circumstantial evidence of man's descent from some lower animal form, that it amounts, in minds trained to embryological, histological and anatomical methods, to the strongest probability.

—— The death of that veteran French naturalist, Henri Milne-Edwards, who at the great age of eighty-five passed away July 29, in his house in Rue Cuvier near the Jardin des Plantes, is a notable event in the history of biological science. Milne-Edwards

will be remembered as a physiologist for his discovery of the principle of the physiological division of labor, as well as his laborious and extensive work, in fourteen volumes, on comparative physiology and anatomy. But as a zoölogist his fame was wider. He was to France what Owen is in England and Agassiz was in America. His special anatomical memoirs were conspicuous examples of the skill and nicety in injection and dissection which characterized the Cuvierian school, his treatises on the organs of circulation of Crustacea being of marked beauty and value. His general zoölogical works were the Histoire Naturelle des Crustacés, published with the aid of Audouin, and with Haime, an extended work on corals. Biologists, being human beings, have a spice of dogmatism and sectarianism in their nature, and in a notice of the great French naturalist in an English scientific journal, it is stated that Milne-Edwards did not late in life change his views as to the origin of species. We never knew, however, of his publicly attacking champions of the new biology. In his son, Alphonse Milne-Edwards, the family name is not now less conspicuous than for the past fifty years as a leading one in French biological science.

—— The U. S. Coast Survey, which for so many years under the direction of Bache and others rendered such signal service to science while pursuing its legitimate work, has been clouded by alleged official misconduct. Charity will be felt for any one who suffers official punishment after life-long services to science and the public welfare. Long before the present civil service reform in politics, the Coast Survey was managed with singular ability and economy. Its work will go on as long as geological agencies produce changes, however minute, in our coast lines and harbor approaches, whether "a thousand years" or more. Our other scientific bureaus have certainly been conducted with far more ability and economy than some departments and bureaus filled by political appointments. Still, rigid economy and business tact will be demanded of our scientific directors and commissioners, as they have been in the past.

—— We have received the following:

Editor AMERICAN NATURALIST—Sir:—In the August issue of your magazine you state: "If the bureaus of the Government would send their return receipts with or in the publications they issue, every one concerned would be greatly accommodated. The return receipts would then be promptly returned, whereas as now sent at another time, it requires time and trouble to identify the package referred to, which sometime results in a failure to return the receipt as desired."

Pardon me if I suggest that the above criticism has been made without due reflection. First, experience demonstrates that the receipts sent with the volumes are returned in a much smaller

per cent than if sent in special letters at other times. Second, if the receipt is sent with the book and the book is lost, the receipt is lost. If the receipt is sent in a separate, special letter, the author expects the book, watches for its arrival, and if it does not come informs the office, and usually in time so that the book may be immediately traced through the mails.

On all accounts it is better to send the receipt by a special letter independent of the book itself, and in advance of the book.

I am, yours cordially,

J. W. POWELL.

Our readers now have both sides of the question. Our own experience as to the ease of returning receipts, differs from that of the distinguished director of the U. S. Geological Survey. But if the department is satisfied with the system no one else need complain.

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RECENT LITERATURE.

FORBES' A NATURALIST'S WANDERINGS IN THE EASTERN ARCHIPELAGO.[1]—Though inferior in general scientific interest and literary execution to Wallace's Malay Archipelago, Mr. Forbes has produced an excellent book of travels, which we have read with much interest. Most of the islands visited by Wallace were also visited by our author, but the routes of the two travelers were in each island different. The book, as the author modestly states, is a transcript of the more interesting of the field-notes made during his wanderings, and is to be "considered" in the light of an addendum to Wallace's "model book of travel."

Besides his observations on the formation of the Cocos-keeling islands and numerous entomological and ornithological notes, the matter largely relates to the botany of these islands, as well as the manners and customs of the natives and mixed races with whom Mr. Forbes was in constant contact. No detailed account of the Timor-laut islands has appeared before that of Mr. Forbes, and little has been published on the inhabitants of the interior of Timor; and, by the way, a residence in Timor, owing to the deadly fever of the coast and the continual warfare between the different villages, was not found to be particularly comfortable. Indeed, considering coast fevers, insect pests, venomous animals, not to mention an occasional tiger, thieving natives, the liability of meeting Malays "running a muck," the jealousy and selfishness of native officials, and tropical heats, rains, earthquakes and an occasional volcanic eruption or cyclone, a naturalist's life in the East Indian archipelago has its lights and shades.

[1] *A Naturalist's Wanderings in the Eastern Archipelago.* A narrative of travel and exploration from 1878 to 1883. By HENRY O. FORBES, F.R.G.S., etc. With numerous illustrations from the author's sketches and descriptions, by Mr. JOHN B. GIBBS. New York, Harper & Brothers, 1885. 8vo, pp. 536.

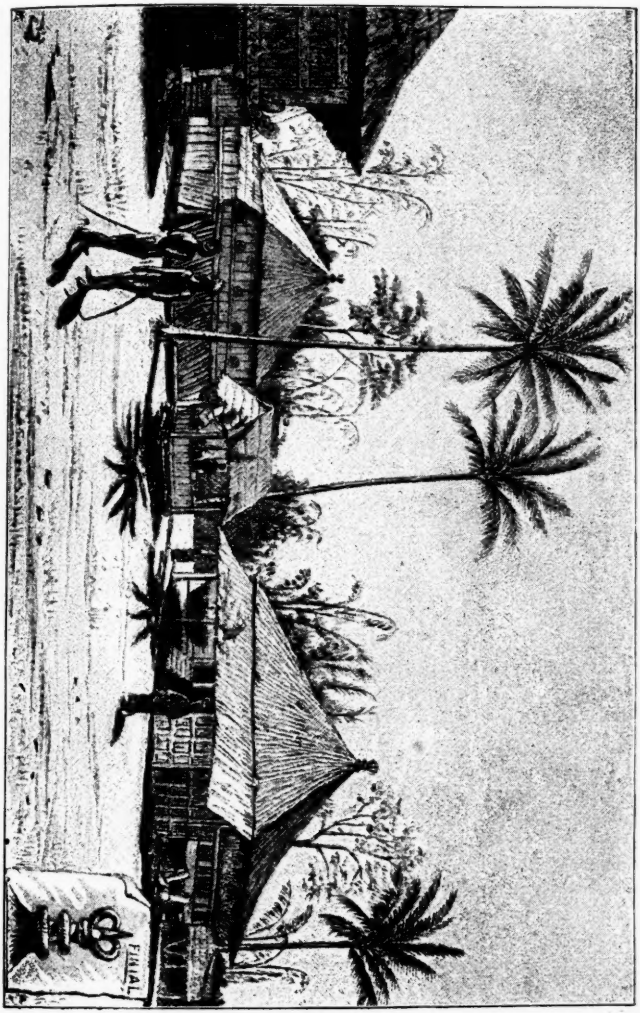
Mr. Forbes' notes and conclusions as to the origin of coral reefs are of interest, as the subject is now under fresh discussion. Visiting the Keeling atoll nearly fifty years after Darwin, he found that the encroachments of the sea on the land "had not increased at all; on the contrary, it struck me that the land was gaining on the lagoon." Between Direction island and Workhouse island he observed what seemed to him signs of recent elevation. His conclusions are in the following words: "I incline to believe, therefore, that the Keeling-reef foundation has arisen as Murray, Semper and Agassiz have suggested; but that its islets have been the result of the combined action of storms and the slow elevation of the volcanically-upheaved ocean floor on which the reef is built."

Among the notes on mammals is an explanation, new to us, of the use of the upturned and hooked teeth of the hog-deer (Babirusa). They are used, he was told by the natives, "to hold to the bottom of ponds by, when hard pressed by hunters."

The author's journey by raft, or rakiting, down the Musi river to Palemberg was remarkably interesting, and the following extract will convey an idea of our author's powers of description when at his best, for at times his style is slovenly and ungainly:

"To recall the magnificent flora of the upper reaches of the river almost makes me retract the statement that the tropics present few flowers; for so blossom-spangled a road it would be difficult to match anywhere;—it is only in the beginning of the wet season, however, and along the steep banks of some such river, wide enough to let in the sunlight and the free breath of heaven, that one must look for, or indeed expect to be able to see such a display. The singular trackless streets, roads and paths of water by which I rambled among the forest avenues are never-to-be-forgotten reminiscences; nor lower down the slow majesty of the widening river between its level banks fronted with tall reeds, dark-foliaged figs, and groves of Eriodendron trees, with their stiff trifid arms; and at last the broad expanse of its united affluents, by whose sources I had for so many months encamped, drawing towards itself the atoms of produce of two degrees of latitude, and concentrating them into a hot nucleus of commercial life and activity. Intermingled with all these memories are a thousand indescribable vignettes; miniatures of quaint works and sandy bays and embossed villages, of out-of-the-world ways and habits and customs, of the intermittent comers and goers; of the changing features of the river's face itself in wind and rain, in early morning or noonday sun, in evening shades, under the pale moon, and in the solemn silence of the darkness. Surveyed from my window in the intervals of occupation, or seated under the veranda in the cool evenings, this changing landscape of days and days (so placid and imperceptible was to me the motion of our gliding down, and so full

PLATE XXXIV.



Village of Kenali.

Native of Wakolo Village, Lake Wakolo.

PLATE XXXVI.

New species of Brugmansia, of the family of the Rafflesiaceæ.

of that exhilarating relief from labor and fatigue) seemed to move past my eyes of its own accord, and afforded me a continued and massive sensation of delight that nothing could disturb, and which can be but faintly conceived by those who have not experienced this uncommon mode of travel which is absolutely different from that by any other water-carriage."

Unfortunately Mr. Forbes lost large collections of plants, and the zoölogical novelties he obtained were not of special importance. Descriptions by various specialists of the new forms discovered are added in fine print, with lists of plants, among them a new species of Brugmansia of the family Rafflesiaceæ.

The illustrations of such a book should be attractive, but on the contrary all are some sort of process work and are exceptionally coarse and unsatisfactory, as samples on Pls. XXXIV–VI. On the other hand the maps are frequent and well engraved.

THE REPORT OF THE FIFTY-FOURTH MEETING OF THE BRITISH ASSOCIATION.—One very tangible result of the last meeting of the British Association, held at Montreal in August and September, 1885, is a volume containing 980 closely-printed pages, besides more than 200 pages occupied by the table of contents, list of members, etc. More than forty reports upon the state of science, by various committees and individuals, and about 340 papers read in the various sections make a total too long for review, and the NATURALIST is therefore compelled to notice only a few of the papers read upon biological and geological subjects. Among these the report of Messrs. Etheridge, Woodward and T. R. Jones, upon the fossil Phyllopoda of the Palæozoic rocks (pp. 75–95), that of Messrs. Sorby and Vine upon the fossil Polyzoa (pp. 97–219), that upon the Zoölogical Station at Naples (pp. 253–263), that on the Archæan rocks of Great Britain, by Professor T. G. Bonney (pp. 529–551), and that upon the characteristics of the North American flora, by Professor Asa Gray (pp. 555–568) may be especially mentioned. A most thoughtful and pregnant article is the address of W. T. Blanford, president of the Geological Section. It deals with the startling exceptions to the rule that beds exhibiting "homotaxis," or similarity of fossil forms, are in reality contemporaneous. By a comparison with each other of the faunas of the Pikermi beds, of the Siwaliks, Gondwana and other fossiliferous strata of Hindostan, and of the Australian coal measures and associated beds, he proves that homotaxis or the want of it is not sufficient to prove the synchronism or lack of synchronism of beds situated in different parts of the world. No less than forty-eight papers were read in the Geological section, and are represented here by abstracts of moderate length.

The address of Professor H. N. Mosely, president of the Biological section, deals with the phenomena of pelagic and deep-sea life, the amount of oxygen, nature and quantity of food, zones of

depth, derivation of the abyssal fauna and other questions which the investigations carried on by the various deep-sea exploring expeditions have brought to the front. Among the remaining fifty-eight biological papers read, it will suffice to mention those of C. Spence Bate on the geographical distribution of the macrurous Crustacea, of P. H. Carpenter upon the geographical and bathymetrical distribution of the Crinoidea, and that of E. A. Schafer on the mechanism of absorption. Many of the papers which are here given in condensed form have also been published at full length in scientific periodicals.

VINING'S "AN INGLORIOUS COLUMBUS."[1]—This volume of more than 700 pages is devoted to the task of proving that Hwui Shan and four other mendicant Buddhist monks, who in 458 A. D. came from Afghanistan to China, and thence proceeded further to the east, really discovered America. The points brought out in favor of this idea are certainly very many and their cumulative force large.

Hwui Shan returned to China in the first year of the Ts'i dynasty, and told many marvelous stories concerning the countries of "Marked Bodies," "Great Han" and "Fu-sang" which he had seen on his journeyings, as well as about a "country of women," inhabited by females with hairy bodies and long locks, who carry their young on their backs and nurse them a hundred days. From the distances given, the size of the countries and resemblances in the habits of the natives, Mr. Vining concludes that the land of "Marked Bodies" is identical with the Aleutian islands, "Great Han" with Alaska, and "Fu-sang" with Mexico, while the hairy women are explained away into monkeys.

Many preceding authorities have noticed or translated Hwui Shan's recital, and Mr. Vining mercilessly quotes them all in the first portion of his work. This is very fair, but makes extremely wearisome reading. After these authorities comes an essay on the nature of the Chinese language, followed by Hwui Shan's text, which is accompanied by eight translations, including that of the author.

After pointing out various resemblances between Buddhism and the worship of Quetzalcoatl, parallelisms between the representations of that god and those of Gautama-Buddha, some curious word-likenesses and certain Mexican traditions which seem to contain intimations of Hwui Shan's visit, Mr. Vining does not forget to tell his readers that the fifth century was so long ago that considerable difference between Hwui Shan's description and the state of things known to us must be expected.

[1] *An Inglorious Columbus;* or evidence that Hwui Shan and a party of Buddhist monks from Afghanistan discovered America in the fifth century A. D. By EDWARD P. VINING. New York, Appleton & Co.

REPORT OF PROGRESS OF THE GEOLOGICAL AND NATURAL HISTORY SURVEY OF CANADA FOR 1882–'83–'84.—This bulky volume is filled largely with matter relating to explorations in Central and Northeastern British America, particularly the region around Hudson's bay. Among the more valuable reports are those by G. M. Dawson on the region in the vicinity of Bow and Belly rivers, Northeast Territory; by Dr. Robert Bell on part of the basin of the Athabasca river, Northwest Terr., and the report of his observations on the Labrador coast, Hudson's strait and bay; while Mr. Ells and A. P. Low give the results of their explorations of the Gaspé peninsula. The geology of portions of New Brunswick is described by Professor L. W. Bailey, while the surface-geology of Western New Brunswick, especially the St. John valley, is reported on by Mr. R. Chalmers. Northern Cape Breton has been explored by Hugh Fletcher. Other reports are of economic interest, while the maps issued with the report form a separate atlas.

WALCOTT'S PALÆONTOLOGY OF THE EUREKA DISTRICT.—This well-illustrated quarto volume forms Vol. VIII of the monographs of the U. S. Geological Survey, and though received in July, 1885, bears date 1884. Heretofore the descriptions of Meek and others of Palæozoic fossils from the far West were based on small collections hastily gathered from more or less widely separated localities by Government exploring parties and field geologists. "We now possess," it is claimed in the letter of Mr. Hague transmitting the present work to the director of the survey, "the results of a careful survey of a district with a rich fauna, through 30,000 feet of Palæozoic strata, representing the Cambrian, Silurian, Devonian and Carboniferous rocks." By means of these fossils Mr. Walcott has endeavored to illustrate the stratigraphic succession and equivalency of the geological horizon in Central Nevada with those described elsewhere.

CURTIS' SILVER-LEAD DEPOSITS OF EUREKA, NEVADA.—This volume forms the seventh of the monographs of the U. S. Geological Survey. It is illustrated by sixteen plates of sections, etc., of the Ruby Hill mines, and the work appears to have been carefully prepared. The summary at the close of the volume, of results, will render the report accessible to miners and experts.

RECENT BOOKS AND PAMPHLETS.

Morris, C.—The primary conditions of fossilization. Ext. Proc. Nat. Sci. Phil., 1885. From the author.

Lesquereux, L.—The Cretaceous and Tertiary floras. U. S. Geol. Surv. of the Territories, Vol. VIII, 1883. From the author.

Smith, E. A.—Report on the cotton production of the State of Alabama. Dept. of the Interior, 1884. From the author.

Nehring, — .—Ueber die Schadelform und dass Gebiss des *Canis jubatus* Desm., in Sitz. den Gesell. natur Freunde zu Berlin, 1885, p. 109. From the author.

Stokes, A. C.—Notes on some apparently undescribed forms of fresh-water Infusoria. Ext. Am. Jour. of Sci., Aug., 1884. From the author.

——Ditto, ditto, No. 2. Ext. idem.

——Some new Infusoria from American fresh waters. Ext. Ann. and Mag. Nat. Hist., June, 1885.

——New members of the infusorial order Choano Flagellata. Ext. Am. Mo. Mic. Journal, Jan., 1885.

——Notices of fresh-water Infusoria. Ext. idem.

Meyer, O.—The genealogy and the age of the species in the southern Old-tertiary, Parts I and II. Ext. Am. Jour. Sci., July, 1885. From the author.

Ayers, H.—Beitrage zur Anatomie und Physiologie der Dipnoer. Sep. Abd. der Jen. Zeits. fur Naturwiss, Bd. XVIII, 1885. From the author.

Putnam, F. W.—Remarks upon chipped stone implements. Ext. Bull. Essex Inst., Salem, Mass., 1885. From the author.

Quick, E. R., Butler, A. W., et al.—Bulletin of the Brookville Society of Natural History, No. 1, 1885. From the society.

Whiteaves, J. F.—Laramie and Cretaceous Invertebrata. Ex. Contr. to Canadian Palæontology. Geol. and Nat. Hist. Surv. of Canada, July, 1885. From the author.

Westbrook, R. B.—In memoriam William Wagner, March 7, 1885. From the author.

Loomis, E.—Contributions to meteorology. Ext. Am. Jour. Sci., Vol. XXX, July, 1885. From the author.

Libbey, W., and Peters, J. E.—Fourth annual report of the E. M. Museum of Geology and Archæology, June, 1885. From the authors.

Dawson, W.—On the Mesozoic floras of the Rocky Mountain region of Canada. Read before Roy. Soc. Canada, May, 1885. From the author.

Garret, D. C.—President's address at the opening of the Twelfth National Conference of Charities and Correction, Washington, D. C., June 4, 1885. From the author.

Lewis, T. H.—Notice of some recently discovered effigy mounds. Ext. Science, No. 106, 1885. From the author.

Heilprin, Aug.—Town geology. The lesson of the Philadelphia rocks. Phila., 1885. From the author.

Albrecht, P.—Ueber Existenz oder Nichtexistenz der Rathke'schen Tasche, aus dem Biol. Centralblatt, IV Band, Nr 23.

——Ueber die Chorda dorsalis und 7 knöcherne Wirbelcentren im knorpligen Nasenseptum eines erwachsenen Rindes. Aus idem, V Band, Nr 5 und 6.

——La Queue chez l'homme. Ext. du Bull. de la Soc. d'Anthrop. de Bruxelles, Tome III, 1885.

——Ueber den morphologischen Werth des Unterkiefergelenkes, der Gehörknöchelchen, und des mittleren und äusseren Ohres der Säugethiere. Sep. Abd. dem Compte-Rendu des otologischen Congress in Basel.

——Ueber die im Laufe der phylogenetischen Entwickelung entstandene, angeborene Spalte des Brustbeinhandgriffes der Brüllaffen. Ext. Sitz. der k. preus. Akad. der Wiss. zu Berlin, Apr. 16, 1885. All from the author.

Lawrence, G. N.—Descriptions of supposed new species of birds of the families Tyrannidæ, Cypselidæ and Columbidæ. From the author.

Gentry, A. F.—A review of the genus Phrynosoma. Ext. Proc. Acad. Nat. Sci. Phil., 1885. From the author.

Bonney, T. G.—On the Archæan rocks of Great Britain. Ext. Proc. Brit. Assoc., Montreal, 1884. From the author.

Newberry, J. S.—Descriptions of some peculiar screw-like fossils from the Chemung rocks. Ext. Ann. N. Y. Acad. Sci., Vol. III, No. 7. From the author.

Bale, W. M.—Catalogue of the Australian hydroid Zoöphytes. Australian Museum, Sydney, 1884. From the author.

Bottger, O.—Materialen zur Fauna des unterere Congo I.

——Materialen zur herpetolischen Fauna von China I. Frankfort, 1885. Both from the author.

Dobson, G. F.—An attempt to exhibit diagrammatically the several stages of evolution of the Mammalia. Ext. Rep. Brit. Assoc., 1884. From the author.

White, C. A.—The application of biology to geological history. Ext. Proc. Biol. Soc. Wash., Vol. III, 1884–5. From the author.

Schlosser, M.—Nachträge und Berichttigungen zu : die Nager de europäischen Tertiärs. From the author.

White, C. A., Heilprin, A., and Ryder, J. A.—A review of the fossil Ostreidæ of North America. Ext. Fourth Ann. Rep. U. S. Geol. Surv., Washington, 1884. From the author.

Russell, I. C.—A geological reconnaissance in Southern Oregon. Ext. idem. From the author.

Call, R. E. and Gilbert, C. K.—On the Quaternary and recent Mollusca of the Great basin, introduced by a sketch of the Quaternary lakes of the Great basin. U. S. Geol. Surv., Washington. From the author.

Lapparent, A. de—Principes de la classification des formations sedimentaires. Ex. du Traité de Geologie, Part 2, 1865. From the author.

Macfarlane, J.—An American geological railway guide. The Dominion of Canada. N. Y., Appleton & Co., 1885. From the publishers.

Baur, G.—On the morphology of the carpus and tarsus of vertebrates. Amer. Nat. extra, July, 1885. From the author.

Boettger, O.—Ostdeutsche Arten im Mosbacher Sand. Sep. Abd. aus Nachr. Platt. d. d. Malakog., 1885. From the author.

Vaillant, L.—Catalogue raisonné des Reptiles et Batraciens d'Assinie. Ext. du Bull. de Soc. Zool. de France, 1884.

——Remarques complémentaires sur les Tortues gigantiques de Madagascar, Ext. Compte Rendus de l'Academie des Sciences.

——Remarques sur l'orientation des œufs dans l'uterus chez les poissons Elasmobranchs ovipares. Ext. du Bull. de la Soc. Philo. de Paris, 1884.

——Remarques sur la disposition des corps vertebraux chez l'*Anaïdes lugubris* Hallowell. Ex. id.

——Sur les caractéres du *Cybium sara* Bennett. Ext. id.

——Sur quelques particularités des squelette chez le *Caranx carangus* Bl. Ext. id.

——Les Campagnes scientifiques du *Travailleur* et du *Talisman*. All from the author.

Desquez, — .—Note sur l'alimentation de l'*Heterodon madagascariensis*. Ext. du Bull. de la Soc. Philo. de Paris, 1884. From the author.

True, F. W.—On a new species of porpoise, *Phocæna dalli*, from Alaska. Ext. Proc. U. S. Nat. Mus., 1885. From the author.

Shufeldt, R. W.—Two uvulæ in a man. N. Y. Medical Journal, June 27, 1885. From the author.

Frazer, P.—Carbons for arc-lamps. Report of examiners of Section VII Intern. Elect. Exhib., 1884. Phila., 1885. From the author.

Whiteaves, J. F.—Laramie and Cretaceous Invertebrata of the Northwest Territory, 1885. From the author.

Dolley, C. S.—The technology of Bacteria investigation. Explicit directions for the study of Bacteria. Boston, Cassino & Co., 1885. From the publishers.

Dollo, L.—Premiére note sur le Hainosaure, Mesosaurien noveau de la craie brune phosphatée de Mesvin-Ciply, prés Mons. Ext. Bull. du Mus. Rey. d'Hist. Nat. de Belg., 1885. From the author.

Ubaghs, C.—Catalogue des collections géologiques paléontologiques conchyliologiques et d'archéologie préhistorique du Musée Ubaghs Maestricht. Liége, 1885. From the author.

Bonney, T. G.—Address delivered at the anniversary meeting of the Geological Society of London, Feb., 1885. From the author.

Fordice, M. W.—A review of the American species of Stromateidæ. Ext. Proc. Ac. Nat. Sci. Phila., 1885. From the author.

Vining, E. P.—An inglorious Columbus. Evidence that Hwui Shən and a party of Buddhist monks from Afghanistan discovered America in the fifth century A. D. N. Y., 1885. From the author.

Baily, J. L.—The constitutional prohibition of the drink traffic. N. Y., 1885. From the author.

Sanchez, J.—Linguistica de la República Mexicana. En Anales del Museo Nacional de Mexico, 1885. From the author.

Curtis, J. S.—Silver-lead deposits of Eureka. Monog. U. S. Geol. Surv., 1884. From the department.

Walcott, C. D.—On the Cambrian faunas of North America. Bull. U. S. Geol. Surv., No. 10. From the department.

——Palæontology of the Eureka district. Mong. U. S. Geol. Surv., 1884. From the author.

Trouessart, E. L.—Description d'un nouveau genre de la sous-famille des Chyleienis. From the author.

——Les acariens parasites des Calaos. La Nature, 13 Juin, 1885. From the author.

The Theosophical Society.—Ext. from minutes of session July 4, 1885, authorizing Professor E. Coues to act as censor of the American Society of Psychical Research.

Lewis, H. C.—Marginal kames. From the author.

Lydekker, R.—Siwalik and Narbada Chelonia. Ser. x, Vol. III, Part 6 of Palæontologica Indica. From the author.

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GENERAL NOTES.

GEOGRAPHY AND TRAVELS.[1]

AFRICA.—*African News.*—The Revs. G. Grenfell and T. J. Comber have contributed to the Proc. Royal Geog. Society an account of their explorations on the Congo. The Bochini or Kwa river was ascended for about 100 miles, and was proved, notwithstanding its apparent smallness, to receive the great river Qwango and also the Njali Pi, or Black river, coming from Lake Leopold II. Between Stanley Pool and the mouth of the Bochini the south bank of the Congo seems almost uninhabited. The journey from Leopoldville to Bolobo was accomplished in four days, traveling ten hours a day. The mouth of the Bochini is in lat. 3° 12′, and is almost closed up by rocks, which obstruct the first thirty miles of the channel. The Ba-buma of this river are regarded by our travelers as the best examples of the African they have met with. They are well-formed, intelligent, friendly, industrious, and seem to lead a happy domestic life. Their chief is a woman, Nga-Nkabe. Tall and stalwart, with a dignified air and queenly pose, Nga-Nkabe evidently knows how to rule. The Qwango comes in from S.S.E. with a depth of two fathoms, a width of 400 or 500 yards and a current of a mile and a half an hour. The houses upon its banks were round, like those seen by

[1] This department is edited by W. N. LOCKINGTON, Philadelphia.

Capello and Ivens 200 miles further south, instead of square like those on the Congo. Women wear a solid brass collar weighing twenty-five to thirty pounds. Our travelers arrived at Bolobo during the saturnalia consequent upon a chief's death, and state their impression that the main characteristics of the people are drunkenness, immorality and cruelty in the most revolting excess. ——Mr. H. E. O'Neill draws attention (Proc. Roy. Geog. Soc., 1885, p. 373) to the neglected port of Nakala, in Fernao Veloso bay, north of Mozambique. It has numerous good anchorages, and offers magnificent conditions for the founding of a colony. Nakala is a deep inlet forming a southern prolongation of Fernao Veloso bay.——Dr. H. Zoller, in his account of Togo land, published in the *Kolnische Zeitung*, states that the streets of the Togo villages are better swept than those of Berlin. Refuse is thrown into large holes, which are covered over when full. The rectangular houses are built of huge bricks made of clay, reeds and straw, the roof is thatched with straw, and the floor is covered with red clay. Sometimes there are two or more apartments, provided with windows having wooden shutters, and occasionally there is an upper floor with a kind of staircase.——The expedition of Messrs. F. L. and W. D. James has returned to England. The Messrs. James intended to cross from Berbera to Magadoxo, but though accompanied by sixty Somali and with Dualla, one of Stanley's best men, for headman, they only succeeded in reaching Barri, on the Webbe river. The greater part of this journey of about 400 miles, was over territory before unvisited by Europeans. Barri is 215 miles from Magadoxo.——Since the departure of Mr. Comber, his colleague, the Rev. G. Grenfell, has ascended the Mabangi, or Ubangi tributary to 4° 30′ N. lat., the Alkere to 2° 50′ N., the Lubilash, or Lomame, to 1° 50′ N., the Mbura to cataracts ten miles from its mouth and the Kelemba, or Ruki, as far as it was navigable, viz., 100 miles. The Sankuru proved an unimportant small stream; the Albangi is *the* river, but the tribes are bad and fierce; and the Ukere is thought to be the Welle (Proc. Roy. Zoöl. Soc., June).——Mr. E. H. Richards, an American missionary, has journeyed from Inhambane to the Limpopo, through a region which is at present a blank on our maps. The Bombom river forms the western boundary of the Portuguese province, and drains a large area of Western Inhambane, as well as the eastern slope of the Makwakwa ridge to the west. The country west of this ridge is semi-deserted in consequence of the raids of Umzila's soldiers. From the Makwakwa ridge to the Limpopo is level land. The Ama-gwaza, or people of Umzila, inhabit or control the country from the Zambesi to the Limpopo, and with the exception of the Portuguese possessions of Chiluan and Inhambane, from the sea in the east to the Matabele country on the west.——It is announced from Lisbon that the Portuguese explorers, Capello and Ivens, have dis-

covered the sources of the Lualaba, Luapula and Chambese, the head waters of the Congo.

ASIA.—*Asiatic News.*—Col. Prejevalsky has discovered three peaks, each over 20,000 feet high, in the middle range of the Kuen-lun. The plateau skirting the middle Kuen-lun has an average height of 4000 feet.——Dr. Gottsche, who has recently returned to Europe after a journey of over 2000 miles in Korea, believes that the population is much underrated. He has visited all the eight provinces and eighty-four out of the 350 districts, and has, through influential support which he received, been enabled to collect much statistical information which is wholly new. He states that the official census only takes into account the adults, and that therefore its nine millions must be increased to over twelve. The geology of Korea seems to be that of the bordering Manchuria. He found few traces of that early development of art and science which made Korea the instructress of Japan.——The labors of Dr. A. Grünwedel and Dr. R. Virchow upon the material brought to Europe by Dr. Riebeck from among the Chittagong Hill tribes, result in emphasizing the already established distinction between the Khyonng-tha, or river tribes, and the Tonng-tha, or hill tribes. The latter (Pankhos, Banjogis, Mros, Kumis, etc.) are darker than the former, and seem to approach nearer the Kolarian aborigines of India. The former (Maghs, Chakmas, Tounjinyas, etc.) have become intermingled with Bengalese and other intruders, and have a yellow complexion. Dr. Virchow is careful to point out that none of these hill tribes lend any support to the theory of an aboriginal Negrito population formerly spread over the whole of India and Indo-China. —— Iturup and Kunashiri, the most southern of the Kuriles, are also the largest. Iturup, according to a recent number of the *Japan Gazette*, is 113 miles long and seventy-seven in greatest width; Kunashiri is sixty-two miles by seventeen. All the Kuriles are very desolate, and only sparsely occupied in summer by Japanese and Ainos, who come to fish. In Iturup there is an impassable jungle of bamboo grass between the coast and the mountains. Professor Milne thinks it not unlikely that the Iturup bear, which seems to resemble the grizzly, may be new to science.——Information has been received at the Hague from Java that the state of Krakatoa was causing some anxiety. Subterranean sounds have been heard, and the rocks which emerged from the sea during the last eruption suddenly disappeared at the end of April.

AMERICA.—*American News.*—Asaph Hall writes to *Science* to contradict the Encyclopædia Brittanica, Appleton's American Cyclopædia and Johnson's Cyclopædia with regard to the height of land in Connecticut. Against the statement of the Ency. Britt. that Connecticut has no land "above a thousand feet in ele-

vation," he gives the following table, based on a survey of the Connecticut Western railroad, made in 1873 by Mr. E. N. Bradford:

Joy mount (Goshen)	1642 feet.
Haystack mount (Norfolk)	1672 "
Bald mount (Norfolk)	1770 "
Bradford mount (Canaan)	1910 "
Bear mount (Salisbury)	2100 "
Brace mount (Salisbury)	2300 "

——F. Gardiner, Jr., in a communication to *Science*, describes a natural bridge sixty-five feet long, fifteen feet wide where narrowest and two feet thick in the center, situated in a small cañon at a distance of about twenty miles from the Atlantic and Pacific railroad, near the boundary of Arizona and New Mexico.—— Lieut. Hohm, of the Danish Greenland exploring expedition, separated from Dr. Eberlin at Tingmiarmint (62° 40′ N. lat.) with the intention of reaching Angmaksalik, in 65° N. lat., where there is a fixed settlement not hitherto visited by Europeans. The heathen East Greenlanders are as tall as the peoples of North Europe, and mostly have dark eyes and hair. They seem to have nothing in common with the Eskimo, yet their utter absence of Norse tradition and total want of civilization, is thought to preclude the possibility that they are descendants of the Norsemen.

GEOLOGY AND PALÆONTOLOGY.

THE RELATIONS OF THE PUERCO AND LARAMIE DEPOSITS.—Some writers having suspected the identity of the formations above named, and the consequence which follows, that the Puerco mammalian fauna was contemporary with the dinosaurian fauna of the Laramie age, the following observations on their stratigraphic relations are now given. They are derived from the notes of several years' residence and exploration by my correspondent, David Baldwin, which connect those made by myself in New Mexico in 1874, published in the Wheeler Survey Report, with those made by Holmes and Endlich in 1878 in Colorado, and published in the Hayden Survey Report.

At the locality where best developed, the Puerco beds have a thickness of about 850 feet, and contain Mammalia to the base (see NATURALIST for April and May, 1885). The Laramie beds succeed downwards, conformably it is thought by Mr. Baldwin; and have a thickness of 2000 feet at Animas City, New Mexico. They rest on Fox Hills marine Cretaceous of less thickness. A few fossils sent from time to time by Mr. Baldwin identify the Laramie. This is especially done by the teeth of the dinosaurian genus Dysganus Cope,[1] which is restricted to the Laramie

[1] Proceedings Academy Philada., Oct., 1876.

formation everywhere. Also by the presence of the genera Lælaps and Diclonius, which in like manner do not extend upwards into the Puerco beds. The Lælaps is principally represented by teeth, which resemble those of the *L. incrassatus* Cope more than those of any other species, although these parts are not alone sufficient for the determination of species in this genus. The Dysganus agrees with the *D. encaustus* Cope, which, with the *Lælaps incrassatus*, was described from specimens from the Upper Missouri. A species of Trionyx and a large crocodile accompany these species. The latter differs in the character of its teeth from any species known to me. The crown is compressed at the apex, and there are two well-marked cutting edges, which slope in such a way as to divide equal faces unsymmetrically, *i. e.*, the greatest convexity of one not being opposite to that of the other; the transverse section resulting being an oblique oval, or at the base a regular oval, with cutting edges at points diagonal to each other. On one side of the tooth thus divided, the surface is grooved by twenty-five strong sulci, which become very fine at the obtuse apex of the tooth. The opposite (external ?) side of the crown is smooth, excepting traces of sulci and silky grooving towards and at the apex. Diameter of crown where broken off, anteroposterior, M. .0125; transverse, .009. No species of this character has come under my observation from the Laramie or any of the Tertiary formations. I name the species *Crocodilus stavelianus*, after Mr. J. Thomas Stavely, one of the enterprising publishers of the AMERICAN NATURALIST.

It is thus evident that the Puerco formation is quite distinct from the Laramie, although it is possible that it may be proper to associate it with the Laramie in the Postcretaceous series.[1] When the Cretaceous mammalian fauna comes to be known, it will be very apt to agree with the Puerco in its leading features. These are, the absence of Perissodactyla and of Rodentia, and of course of mammalian orders not found below the Miocenes; and in the constitution of the mammalian fauna by Condylarthra, Bunotheria and Marsupialia exclusively. The Postcretaceous series as a whole may be ultimately distinguished from the tertiary by these peculiarities, together with the presence of the reptilian genus Champsosaurus.—*E. D. Cope.*

CROSBY'S CONTINENTS AND OCEAN BASINS.—W. O. Crosby (Proc. Bost. Soc. Nat. Hist.) discusses the origin and relations of continents and ocean basins. Reviewing the hypotheses of Thomson, Dana, Le Conte and others, he arrives at the conclusion that existing facts necessitate the existence of a plastic zone beneath the solid crust, this zone occupying the stratum at which temperature is highest in proportion to pressure. As the infiltration of

[1] This has been done in the table of formations in Vol. III U. S. Geol. Survey, F. V. Hayden, Tertiary Vertebrata, p. 42.

water increases the tendency to fusion, it is probable that this plastic zone commences at a depth of about forty miles. The interior of the earth may have a rigidity exceeding that of steel, but even if, according to the ideas of Wadsworth and some others, the interior is liquid, this does not affect the action of the surface zone of liquid matter upon the solid crust above it. The two opposing theories of continent formation are thus stated: (1) Continents and ocean basins are upward and downward bendings of the earth's crust; (2) the continents and ocean basins are due to the greater conductivity and more rapid cooling of the continental portions of the earth's crust, hence they are permanent, and the continents are wider and the seas deeper now than at any former period. The hypothesis of the earth's unlike composition along different radii is necessary to the second theory, and is here stated to be unsupported by evidence. According to the former theory the grand distortion which the crust experiences before the strain becomes great enough to crush it, accounts for the continents, while the ultimate crushing produced the mountains.

Mr. Crosby does not, therefore, believe in the permanency of continents, which is held by many geologists as an article of faith. We have, he argues, certain knowledge of a Palæozoic subsidence of 40,000 feet in the Alleghanies, a Mesozoic subsidence of 50,000 feet in Central Europe, and, according to King, a subsidence of 60,000 feet in the Rocky mountains. With these facts in mind how can it be held that any part of the floor of the deep sea ever has been or will be elevated to form dry land?

GEOLOGICAL NEWS.—*General.*—All the geological formations are met with in Japan, but the Palæozoic formations embrace the largest extent of territory. The Trias occurs in the north and south-west of the main island and in Shikoku. Chalk is also widely distributed in Niphon, Yezo and Shikoku. The Cenozoic occurs everywhere on the edges of the older mountain ranges. Basalt is rare, the volcanic rocks are mostly trachyte and andesite, and granite covers an area only second to that occupied by the Palæozoic formations. Volcanic tuff, consisting principally of decomposed silicates, is among the soils of Japan, and forms most of the uncultivated plains at the foot of the mountains. The geological and topographical survey of Japan has worked over an area of about eighty geographical miles square.

Palæozoic.—Mr. O. A. Derby states (Geog. Physica do Brazil, Vol. 1) that the Brazilian tablelands are composed of horizontal or nearly horizontal beds. The basis of the plateau consists of ancient metamorphic rocks; these form nearly the whole of the mountain and mountainous tablelands, and appear whenever later rocks have been denuded. They thus occur at the bottom of nearly all river valleys. The older of these rocks are highly crystalline, the newer less crystalline. The granites, syenite,

gneiss, etc., of the first series is supposed to be Laurentian, while the quartzite schists and limestones, etc., of the second series are Huronian. The latter series is the great mineral repository of Brazil. Here occurs the schistose micaceous quartzite called itacolumite, itabirite, in which the mica is replaced by micaceous iron and extensive beds of hematite and other iron ores, and gold. Tapanhoacanga, consisting of masses of iron ore cemented by limonite, is often very rich in gold. The Serra do Espinhaço is capped with sandstone believed to be Silurian, and probably a part of the sandstones of the Sao Francisco-Tocantins divide are also Silurian. The tablelands of the Parana basin, composed of sandstone and shale with some limestone, are probably Devonian and Carboniferous. Devonian fossils characterize an extensive area in the Campos Geraes de Parana, while the Carboniferous covers a large region farther to the westward in the same province, and in Sta Catherina, Rio Grande do Sul and Southern and Western Sao Paulo. Coal has been found at various points. Immense dykes of diorite traverse these two formations, and by their decomposition afford a dark red soil called *terra roxa*.——O. A. Derby (*Am. Jour. of Science*, Sept., 1884) shows that the flexibility of itacolumite is only a surface quality. In a cutting upon the Rio and Minas railroad (Brazil) a thickness of forty meters of itacolumite is laid bare. The upper portion consists of massive beds from one to three meters thick, in which flexible portions are rarely found. In the lower part the beds readily divide into thin laminæ, most of which are more or less flexible. Exposures of unweathered itacolumite are rare, and from the study of this Mr. Derby concludes that flexibility is not an original characteristic of the rock but a phase of weathering brought about by percolating waters.

Silurian.—Sr. Leon Tourquist has published descriptions of 113 species and varieties of trilobites discovered in the Silurian basin of Siljan, in Dalecarlia. The descriptions mainly rest on detached heads and pygidia, as the fossils are fragmentary.

Carboniferous.—S. H. Scudder has described two new Carboniferous insects from England. One of these can with certainty be referred to Brongniart's group of Protophasmida. The wing is broadest in the middle, and from the appearance of the fragment, which is 75^{mm} long, must have had a length of 130^{mm}, so that the living insect probably possessed an expanse of wing of at least ten inches.

Cambrian.—Mr. W. O. Crosby (Proc. Bos. Soc. Nat. Hist.) defends his previous conclusions respecting the relations of the conglomerate and slate in the Boston basin. He maintains that the conglomerate underlies the slate, that there is essentially but one formation of conglomerate and one of slate; that both are Primordial, or at least Cambrian, and that the Boston basin con-

tains no Carboniferous beds. He declares that the Carboniferous shales and sandstones are quite distinct lithologically from the slates of the Boston basin, which latter, as well as the conglomerate, are traversed in all directions by numerous and large dykes of trap or diabase, while no eruptive rocks have ever been discovered in the adjacent Carboniferous. The rocks are decidedly homogeneous, passing gradually into each other, and have also a general agreement in strike and dip. The conglomerate underlies the slate, not because it is older than the slate, but because it was deposited in shallow water, the slate in deeper, and the latter deposit commenced before the first was completed. In not a few instances the conglomerate can be seen to pass beneath the slate.

Jurassic.—A specimen found in the Waldean of Hastings (Eng.) throws some light on the structure of the sternum in Iguanidæ. It consists of an azygos bar, from near one end of which diverge two smaller rods which terminate mesially in expanded ends. Professor I. W. Hulke regards the diverging rods as clavicles, and the azygos bar as the interclavicle, and suggests that the costal sternum may have been cartilaginous.

Cretaceous.—M. Ch. Arnat (Rev. Scientifique) describes the geological structure of the Saharan district of M'zab. This principally consists of an elevated plateau (*hamada*) of Cretaceous rocks, rising toward the north-east into a cliff facing the basin of the Oued Loua, while toward the south-east it is lost beneath the alluvium of the Oued Rhir. Thus this rocky plateau, which is entirely desolate and without running water, is bounded east and west by alluvial deposits. Calcareous concretions mark the passage between the two formations. The few fossils indicate that the strata must be placed between the Gault and the white chalk (Turonian and Cenomanian). The calcareous crust forming the soil of the plateau is Taranian, while the escarpments formed by the marls, as well as the marly limestones, are Cenomanian.—— Professor Lundgren, in his monograph of the Swedish Cretaceous Brachiopoda, states that the Cretaceous strata which occupy an extensive area in the province of Skeine, at the southern extremity of the country, have peculiar petrographic and palæontological characteristics in the three districts of Kristianstad, Ystad and Malmö. Those of Kristianstad are chiefly *gruskalk* (a limestone composed of the fine débris of shells of mollusks and echinoderms) with a mixture of quartz sand-grains and occasionally metamorphic boulders. In Ystad the prevailing rocks of the Cretaceous strata are incoherent calcareous sandstones, with a variable quantity of green grains; while in Malmö the beds are pure white chalk of various degrees of hardness, with abundant layers and nodules of flint. These Malmö beds are an easterly continuation of those of Denmark, and closely resemble those of

Norwich (Eng.). In Malmö the upper chalk is overlaid by the Danien, or newer chalk, which is without belemnites or Belemnitella. From the upper chalk the only new species described is a Lingula, but from other horizons there are sixteen new forms. The most prolific brachiopod fauna is the lower division of the Kristianstad district, characterized by *Actinocamax ventricosus*.

Tertiary.—Ernst Hoken has endeavored to ascertain the groups of fishes to which belong the otoliths, which are the most common remains of bony fishes in the Oligocene of North Germany. He finds the Gadidæ predominate, but identifies also species of Percidæ, Sciænidæ, Sparidæ, Triglidæ and Pleuronectidæ.—Although Professor Marsh's book on the Dinocerata bears date 1884, the first copy was received from the binders towards the end of February, 1885.——Mr. J. S. Gardner, in a lecture upon the Age of the Basalts of the North-east Atlantic, states that the determination of the Antrim basalts as Miocene is not satisfactory; and that the assumption that all floras comprising modern and temperate-looking genera (such as willow, beech, alder, hazel, poplar, elm, pine, liquidambar) must be Miocene, while a flora of palms, Proteaceæ, figs, Aralias, etc; must be Eocene, is erroneous. The whole of the American flora with Dicotyledons would have been absorbed into the Miocene had it not been for stratigraphical evidence. The so-called Miocene plants of Greenland are, by Mr. Gardner, referred to the middle Eocene, and the unfossiliferous beds below their horizon to the base of the Eocene. The basalts in Ireland restore the upper chalk. In conclusion Mr. Gardner said—"I think we may assume that the old land on which this flora (that of the middle series of the Irish basalts) grew formed a part of the continent of Europasia, in Eocene times, and further that it formed or was not distant from its western coast line." Mr. Gardner believes that the silicified wood and lignites of Lough Neagh, may be derived from the basalts. The prevailing conifers of these Eocene basalts are a cypress, a cryptomeria and a pine.

Post-Glacial.—W. O. Crosby (Proc. Bost. Soc. Nat. Hist.) gives what seems a very probable explanation of the gorge called Purgatory, at Sutton, Mass. The chasm is about 50 feet wide, with vertical walls, and pierces the micaceous gneiss of the region. He suggests that during some disturbance of the earth's crust, the wedge-shaped mass of rock between two master joints has dropped. This idea is in accord with facts. The chasm is parallel to a well-defined system of joints, and its walls are evidently joint-places. There are no evidences of marine erosion to support Dr. Hitchcock's theory. The date of this chasm must be post-glacial, as, if it lay in the path of the ice-sheet, it would have been filled with glacial detritus. The explanation will of course apply to some other similar gorges.

Quaternary.—Prof. A. Nehring (Sitz. Ges. naturf. Freunde, Berlin) asserts that the horse existed in Europe during the

diluvial age. At that time middle Europe was a land of steppes, and a strong-kneed, thick headed, medium-sized wild horse existed there. Later on the steppe became covered with forest, the moist climate of which was unfavorable to the horse, which became confined to the pasture grounds and thus fell more and more under the influence of domestication, whilst it degenerated into the small weak-kneed horse found in the moors of Northern Germany, in some pile-dwellings, and in the "Kreisgruben" of Oldenburg. The descendants of this European horse can still be traced in some breeds. This view does not shut out the idea that the introduction of the Asiatic horse may have contributed to the change of type.

Recent.—Dr. R. v. Lendenfeld has found undoubted traces of glaciation throughout an area of 100 sq. miles upon the highest part of the Australian Alps, at elevations of above 5800 feet. The rocks showing traces of ice-action are all granite.

MINERALOGY AND PETROGRAPHY.[1]

TESCHNITE.—Dr. Carl Rohrbach[2] has made a thorough reëxamination of all the occurrences of teschnite of which he could obtain specimens, and concludes that this rock is not entitled to the position to which it was assigned by Rosenbusch in his system of rock classification published in 1877.

The paper opens with a valuable review of the literature of this much discussed rock-type. The best known localities are those in the neighborhood of Teschen, in Moravia, where the rock, as early as 1821, was described as a diorite. This determination appears to have been regarded as satisfactory until Hohenegger threw doubt on it, and in 1861 proposed to call this in many respects peculiar group of rocks "teschnite." This name was accepted by Tschermak, in 1866, for the lighter colored varieties, while he designated the darker ones as picrite. Zirkel, in 1868, and Tschermak, in 1869, first mentioned nepheline as a constituent of these rocks. In 1877 Rosenbusch published the results of his examination of these rocks, which he defined as pre-Tertiary plagioclase-nepheline aggregates, and as such assigned them a very important place in his classification. Other masses of a similar age and mineralogical composition have been described by Tschermak from the Caucasus, and by McPherson in Portugal. Analcite, supposed to be an alteration of the nepheline, is a common constituent at all of these localities.

As the principal primary constituents Dr. Rohrbach designates plagioclase, augite, hornblende, biotite, olivine, magnetite and apatite. The augite is called "automorphous" when it is present

[1] Edited by Dr. GEO. H. WILLIAMS, of the Johns Hopkins Univ., Baltimore, Md.

[2] Ueber die Eruptivgesteine im Gebiet der schlesisch-mährischen Kreideformation. Tschermak's Min. u. Petr. Mitth., VII, pp. 1–63.

in well defined crystals, and "xenomorphous" when it merely fills the spaces left between the plagioclase crystals, as is common in rocks of the diabase type. A compact brown hornblende is a common constituent and presents the most interesting relations to the augite. These are described at length and admirably illustrated in a colored plate. This hornblende which very frequently makes up the outer portion of a pyroxene crystal, is regarded as in no way of secondary origin, but as an original crystallization due either to changes in chemical composition or physical conditions in the magma. The following analyses of the two minerals illustrate instructive chemical differences:

	Augite.	*Hornblende.*
SiO_2	44.22	36.91
Al_2O_3	10.49	16.30
Fe_2O_3	11.98	5.28
FeO	5.77	12.27
MgO	7.02	8.83
CaO	22.54	16.91
	102.02	96.50

The hornblende contains 3.5 per cent of alkalies.

The nepheline Dr. Rohrbach was unable to discover in any specimens of teschnite from either Moravia, Caucasus or Portugal. He thinks that what has thus far been considered to belong to this species is in reality apatite, and would hence strike teschnite from its place in Rosenbusch's system.

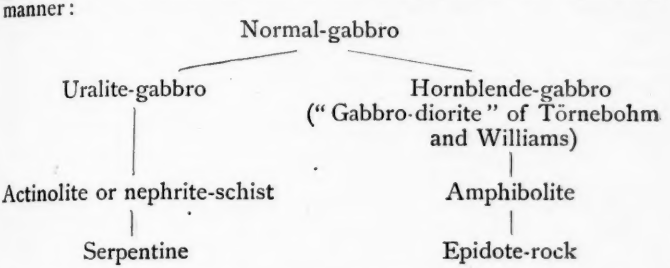
[Even in case Dr. Rohrbach's results regarding the presence of nepheline in the specimens examined by him are entirely correct, no account has been taken of the dykes of ancient plagioclase rocks occurring in the Silurian limestone near Montreal, in Canada, which, according to Drs. Hawes and Harrington, are undoubtedly rich in nepheline. This mineral is often present in large sharply-defined hexagonal crystals closely resembling those so characteristic of the Katzenbuckel "nephelinite."—*G. H. W.*].

METAMORPHOSIS OF GABBRO.—The widespread origin of hornblendic schists by the uralitic alteration of massive pyroxene rocks receives additional evidence in its favor wherever the attention of geologists is especially directed to it. The observations of Lehmann in Saxony, Reusch in Norway, Phillips in England, Becke in Austria, Streng and Irving in the region about Lake Superior in the U. S., all indicate the great geological importance of molecular changes in producing amphibole schists from pyroxene eruptive rocks. The studies of Kloos[1] in the Black Forest point to a like relation between the gabbros and diorites of Ehrsberg. Mr. Frederick H. Hatch, of London, has contributed a similar investigation of the gabbro occurring at Wildschönan in the

[1] Neues Jahrbuch für Min., etc., III, Beil. Bd.

Tyrol, and of the associated hornblende schists, which he regards as having undoubtedly been derived by its uralitization.[1] Several wood-cuts illustrate the different stages of the alteration as it was observed under the microscope, The writer finds that the schistose structure is developed in the rock in proportion as the alteration of the pyroxene to hornblende has progressed, and is hence inclined to attribute both to the action of great pressure.

Two parallel series of alteration which have gone on in the gabbros of Wildschönau, the writer illustrates in the following manner:



PETROGRAPHICAL NEWS.—Barrois[2] and Des Cloizeaux[3] have recently made important contributions to our knowledge of the physical characteristics of the minerals of the chloritoid group, which are becoming more and more generally recognized as widely distributed rock constituents. Van Werveke[4] publishes the results of a new microscopical study of a large amount of petrographical material in which this class of minerals plays an important rôle. This consists of the ottrelite schists occurring near Ottré and Viel-Salm in the Ardennes. These he divides into ottrelite-phyllite proper, garnetiferous ottrelite-phyllite, magnetiferous ottrelite-phyllite and ottrelite-bearing quartz-breccia. —— Professor E. Cohen, formerly of Strassburg, who has recently been called to the University of Greifswald, has a letter in the Neues Jahrbuch für Mineralogie,[5] in which he revises the determination of the diallage in the Schriesheim picrite, made by him some twelve years ago. The resemblance of this rock to certain olivine rocks occurring near Peekskill, on the Hudson river, is very striking. In them large bronze-like cleavage surfaces of hornblende are mottled with much smaller grains of olivine and pyroxene. An almost identical mineral occurs in the Schreisheim rock, which was formerly considered by Cohen as diallage, but which now,

[1] Ueber den Gabbro aus der Wildschönau in Tirol und die aus ihm hervorgehenden schiefrigen Gesteine. Tschermak's Min. und Petrog. Mitth., VII, 1885, pp. 75–87.
[2] Bull. soc. min. de France, VII, p. 37, 1884.
[3] Bull. soc. min. de France, VII, p. 80, 1884.
[4] Neues Jahrbuch für Min., etc., 1885, I, pp. 227–235.
[5] 1885, I, p. 242.

upon reëxamination, proves to be also hornblende. The writer proposes to call this type of rock, composed essentially of olivine and hornblende, "hudsonite," on account of its being so well developed at Stony point, on the Hudson river. [The name "hudsonite" was applied, as early as 1842, by Beck to a variety of augite occurring near Cornwall, on the Hudson river. It would therefore seem preferable, if a new name is considered necessary, to employ some other than that proposed by Cohen. The present writer has elsewhere suggested "cortlandtite" as appropriate, since this rock is such a typical member of Professor Dana's "Cortlandt Series."—*G. H. W.*]——Dr. K. Oebbeke,[1] of Munich, communicates some observations made by him on a specimen of andesite from the summit of Mt. Tacoma, Washington Territory. The question of the existence of pleochroic augite is again discussed and regarded as undecided in spite of the work of Cross, Hague and Iddings on the western hypersthene-andesites. If the matter is still in doubt it must be confessed that Oebbeke here furnishes but little convincing evidence in favor of a pleochroic monoclinic pyroxene.——R. D. M. Verbeek[2] makes some interesting remarks on the recent lavas of the East Indian archipelago. These are, for the most part, hypersthene-andesites, or, as this writer prefers to call them on account of the presence of both hypersthene and augite, "pyroxene-andesites." The hypersthene is almost always in excess of the augite. Pure augite andesites have not been observed, but such as contain only hypersthene rarely occur. The complementary rôles played by the hypersthene and olivine in these rocks was noticed by Verbeek independently of Hague and Iddings, who discovered and described the same in their notes on the hypersthene andesite and basalt of the Western U. S. in 1883.——Mr. G. P. Merrill,[3] of the U. S. National Museum, has published some notes on the hornblende andesite from the new volcano on Bogosloff island, in Behring sea. They are quite normal in appearance, containing lath-shaped plagioclase crystals, brown hornblende and green augite imbedded in a microlitic base. Two varieties are distinguished, one light colored with fifty-six per cent of silica and the other much darker with fifty-one and a half per cent.

BOTANY.[4]

BOTANICAL WORK OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.—The Ann Arbor meeting of the association, just closed, proved of more than usual interest to the botanists. There was a notable increase in the permanent value of the papers. They were much more thoughtful, as a rule, than

[1] Neues Jahrbuch für Min., etc., 1885, I, p. 222.
[2] Neues Jahrbuch für Min., etc., 1885, I, p. 243.
[3] Proceedings of the U. S. National Museum, Vol. VIII, 1885, p. 31.
[4] Edited by PROFESSOR CHARLES E. BESSEY, Lincoln, Nebraska.

those presented at previous meetings, and came up more nearly to the standard demanded by the science of to-day. Below we give brief abstracts, which will show the general nature of the papers.

"An observation on the hybridization and cross-breeding of plants," by E. Lewis Sturtevant. This gave in detail the observations on crossed beans, maize, barley, peppers, tomatoes, lettuce and peas, made at the New York Agricultural Experiment Station. As a result of the observations the author concludes that in our domesticated vegetable plants cross-fertilization shows its effects at once in the reproduction of the form-species and varieties which are involved in the parentage of the crossed seed, or, in other words, the effect is *atavism* rather than a blending of properties.

"Germination studies," by the same author, gave the results of making numerous duplicate germinations, showing that different percentage-results are obtained as the quantity of seeds used is large or small. The influence of various temperatures was also discussed. These two papers will appear in the NATURALIST.

"The question of bisexuality in the pond-scums," by Charles E. Bessey. It has been held by some botanists that the pond-scums (Zygnemaceæ) show a distinct bisexuality, one of the filaments being male, the other female. Certain facts were presented which render such a view untenable. In many plants the cells of the same filament fertilize one another, as is notably the case in the forms which have been described as Rhynchonema. Several cases of hybridization were cited in which two filaments, both of which bore resting-spores, united with one another and produced a hybrid spore. The conclusion was that the pond-scums are not bisexual, but rather unisexual, that is, that while sexuality undoubtedly exists, there is as yet no differentiation into the proper male and female. Accordingly these plants must take a position just above the asexual prototypes, but below the clearly bisexual oöphytes.

"The process of fertilization in *Campanula americana*," by Charles R. Barnes. This species is strongly proterandrous. The pollen is scraped out of the anthers by the hairy style and brushed off before the stigmas open, thus securing cross-fertilization. The development of the pollen is normal. The stigmas are held together till mature by interlocking papillæ. The hairs on the style become partially introverted, thus freeing the pollen.

The pollen spore contains two nuclei, the larger of which, the vegetative, becomes disorganized shortly after entering the pollen tube, while the smaller spindle-shaped generative nucleus persists.

The embryo-sac is cylindrical, with a gradual enlargement near the micropylar end, where is located the egg-apparatus, and an abrupt enlargement at the chalazal end, in which lie the antipodal cells. There are usually two sac-nuclei.

The pollen-tubes enter the style *between* the bases of the papillæ of the stigma, pass down in the strands of conducting tissue, and *not* through the central canal, around which this tissue is arranged. The paper was followed by an account of the methods used, and illustrated by figures drawn upon a large chart.

"Proof that Bacteria are the direct cause of the disease in trees known as pear-blight," by J. C. Arthur. Cultures of the bacterium taken from blighted twigs were made in sterilized corn-meal juice. After a few days some of the bacteria, which had increased rapidly in this medium, were transferred (a drop only) to another sterilized preparation of corn-meal juice. After a few days another transfer was made, and this was continued until the sixth culture had been reached, when there was presumably but an infinitesimal amount of the original diseased juice present. Inoculations made with the bacteria of the last culture resulted in producing the blight as certainly and rapidly as in the first case.

The crucial experiment was made by filtering a watery solution containing the bacteria, and then inoculating with the bacteria on the one hand and the filtration on the other, resulting in blight in the former and none at all in the latter case.

"The mechanical injury to trees by cold," by T. J. Burrill. There are two kinds of mechanical injury due to a low temperature, viz: (1) The cracking and splitting of the bark and wood in a longitudinal-radial direction; and (2) the separation of the concentric layers of wood and bark, and especially the rupture of the cambium, thus destroying the bark and perhaps also killing the tree.

The first injury is due to the shrinking of the tissues by cold. The second is due to the growth of ice-crystals in the annual rings or on the surface of the wood.

"Further observations on the adventitious inflorescence of *Cuscuta glomerata*," by Charles E. Bessey. A further examination shows that it is the universal rule in this species for the inflorescence to develop from lateral adventitious buds, and that no normal inflorescence is developed. The adventitious inflorescence always bears a definite relation to the parasitic roots; that portion of the stem which bears roots produces adventitious inflorescence, and the greater the number of roots the greater the mass of inflorescence. No adventitious inflorescence is produced upon any portion of the stem which does not bear roots.

The stem proper (main axis) all dies away very soon, not only between the inflorescences but in the masses of inflorescence also. The flowering stems soon establish direct structural relations with the root, and thus with the host plant. Of other species thus far examined, *Cuscuta arvensis* does not produce adventitious inflorescence, while *C. chlorocarpa* and *C. gronovii* produce an abundance of both the normal and the adventitious flower

clusters, and in both cases the flowers, fruits and seeds appear to be well developed.

"On the appearance of the relation of ovary and perianth in the development of dicotyledons," by John M. Coulter. An examination of many species of dicotyledons (belonging to the orders Ranunculaceæ, Leguminosæ, Rosaceæ, Saxifragaceæ, Onagraceæ, Rubiaceæ, Umbelliferæ, Compositæ, Borraginaceæ, Scrophulariaceæ and Labiatæ) shows that in every case the first character recognized in the development of the flower is that of inferior or superior ovary, and that a most simple grouping of the orders upon that basis is possible. Grouping the dicotyledons upon this basis results somewhat as follows: The Compositæ take place at the head of the list, then near them come the Umbelliferæ, Rubiaceæ, etc., etc. The intermediate orders which have inferior and superior ovaries, as the Rosaceæ and Saxifragaceæ, would occupy a proper intermediate position, and finally those with superior ovary or ovaries only, as the Scrophulariacæ, Labiatæ, Leguminosæ, etc., would be arrayed in a descending series.

"The development of the prothallium in ferns," by Douglass H. Campbell. The paper gave the details of many observations upon the development of the prothallia of ferns, accompanied by figures of the various stages.

"Notes upon some injurious Fungi of California," by William G. Farlow. The author observed *Peronospora hyoscyami* D.By. growing abundantly upon *Nicotiana glauca*, a shrubby plant, native of Buenos Ayres, which is now common in Northern Mexico and Southern California. As the shrub is a near relative of the cultivated tobacco, *Nicotiana tabacum*, there is danger that the parasite may be transferred from the former to the latter.

The hollyhocks of California are affected by a rust (Puccinia of some species) which was at first supposed to be identical with the hollyhock disease of Europe (*Puccinia malvacearum*). It is, however, entirely distinct, being the same species as that which occurs upon species of Malvastrum in some of the Western States. There is danger that this may become transferred to the cotton plant.

"A new chromogenous Bacillus," by D. E. Salmon and Thomas Smith. A Bacillus, named *B. luteus suis*, was found in the pericardial effusion of hogs affected with swine plague.

THE BOTANICAL CLUB OF THE A. A. A. S.—About seventy members of the association registered themselves as botanists at the Ann Arbor meeting. Every member of the club wore a yellow ribbon in addition to the regular association badge. Six sessions of the club were held in the university buildings, one of them occurring in the botanical laboratory.

During the first session a committee was appointed to take

into consideration the question of English names for the fungi and the diseases produced by them. The committee is composed of J. C. Arthur of Geneva, N. Y., Wm. G. Farlow, Cambridge, Mass., and Wm. Trelease of St. Louis, Mo., who are to act in conjunction with F. L. Scribner of Washington, D. C.

A committee was also appointed to take into consideration the relations of the botanists of the country to the National Herbarium at Washington. This committee, consisting of John M. Coulter of Crawfordsville, Ind., and Wm. J. Beal of Lansing, Mich., reported in favor of asking that the herbarium prepare a catalogue of its specimens and books so that the botanists may know what is to be found in it for consultation, and also in order that desiderata may be known to those who are able to supply them.

Professor Beal read a few notes upon laboratory methods. This was followed by discussion and a general interchange of notes.

Professor Halsted exhibited specimens of a wild grape from Iowa completely covered with *Peronospora viticola*. Near these specimens were many vines whose leaves were free from the parasite but whose *berries* were badly affected.

D. H. Campbell exhibited an organism from the Detroit river which he thought to be an alga. Other members doubted its vegetable nature. It was referred for further examination and study.

Professor Coulter presented a list, with comments, of the plants collected by the Greeley expedition.

Professor Barnes described the peculiar dehiscence of the fruit of *Campanula americana*, in which a peculiar little flap opens and lets the seeds out when the weather is dry, but closes when it is wet.

Professor Lazenby presented an additional list of plants new to the Ohio flora.

During the session in the botanical laboratory the whole time was given to the discussion of laboratory methods, and examination of various microscopes and of the laboratory books on the shelves in the room.

Professor Burrill called attention to the grape disease due to *Sphaceloma ampelina* D.By. Specimens were exhibited and passed around among the members of the club.

Mrs. Wolcott described an abnormal form of Campanula which had suddenly appeared in her garden, which provoked a discussion on weed seeds, in which it was suggested that many weeds survive in fields and meadows by the yearly growth of depauperate plants which, though small, produce perfect seeds.

Professor Barnes showed that the figures given in most books of the stomata of *Marchantia polymorpha* are erroneous in not

showing the guard cells, which lie at the bottom of the chimney-like structure.

F. L. Scribner gave some hints upon the making of drawings from botanical specimens.

Geo. U. Hays of St. Johns, N. B., sent a paper on the botanical features of New Brunswick, which was read by the secretary. The low temperature and damp air have affected the flora so that it is quite peculiar.

Professor Bessey described his herbarium cases which have doors which are readily removed entirely, and which he uses for tables by placing them upon trestles or flat backed chairs.

D. H. Campbell described the germination of Botrychium spores in so far as his observations had progressed. He succeeded in germinating the spores by constructing a box in such a way that the spores were under ground.

He also called attention to the crystals in the petiole of Onoclea.

J. C. Arthur exhibited specimens of Nepaul barley (*Hordeum trifurcatum*) in which the awns take a hood-like development, and in this hood additional flowers are found. The structure is very puzzling, as it appears that here a flowering glume (outer palet of the older books) bears flowers towards its upper extremity.

Dr. Walker, of New Orleans, mentioned a case of degeneracy of Indian corn. Kernels of Nebraska corn were planted in a pot in New Orleans, and produced perfect fruiting plants only fifteen inches in height.

The officers for the next meeting are John M. Coulter of Crawfordsville, Ind., chairman; J. C. Arthur of Geneva, N. Y., secretary.

The excursion on Monday afternoon to Tamarack swamp was very enjoyable, and to the younger botanists very profitable.

ENTOMOLOGY.

Dr. Brauer's Views on the Classification of Insects.—In a work entitled "Systematisch-zoologische Studien," extracted from the ninety-first volume of the Proceedings of the Academy of Sciences at Vienna, Prof. Brauer, after a long introduction on evolution, makes many valuable and suggestive remarks on the following subjects: The insect orders now existing did not originate from one another but from ancestors closely allied to one another; affinities of Eugereon; the forms of insects the earliest and last to appear in different formations; hypothetical ancestral forms; no primitive forms connecting the existing orders of insects yet found; necessity of the dismemberment of some existing orders which are now mingled together; how the orders should be characterized; thoughts on the origin of the winged insects; division of insects into originally wingless, and secondarily winged or wingless forms; relations of the mouth-parts in larvæ and imagines or

their different changes of form; necessity of the increase in the number of orders based on the structure of the mouth-parts; relations of the parts of the thorax; relation of the thorax to the hind-body (1. Value of the relations of the abdomen to the thorax and organs of locomotion. 2. Ancestral forms, retrograde developments); genealogy; deceptive similar adaptive forms of different orders give the delusive appearance of a common descent or of a union in a single order; basis of the establishment of a peculiar (eigenen) order; the nymph as the stopping place (anhaltspunkt) for genealogical researches; the larva and genealogy; homologies of the nymph stages; relation and similarities between the ametabolic and metabolic insects; registered or artificial orders; how valuable the secondary or primitive larval forms may be to the systematist; orthognath and hypognath larva and imago; what points are to be considered in the use of the larvæ in classification; systematic characters of the same; characters taken from the structure of the nervous system; relations of the young form to the grown-up animal within the limits of a single order which are important for the determination of the grades of development; Packard's superorders; position of the sixteen series of forms not connected by intermediate links; relation of the allied series in different directions; view of the groups considered as orders; supposed greater allied groups; and, finally, the characteristics of the subclasses and orders of insects.

Professor Brauer claims that exact researches on the existing insects lead to the establishment of sixteen groups, or orders, which are not connected by intermediate types. "The path to a common ancestral form is interrupted in many places. Moreover, fossil remains do not fill up the gaps." The fossils yet discovered show, he adds, that our so-called orders of insects have a high antiquity, for we find in the Paleozoic strata typical representatives, and indeed highly developed forms; he adds, emphatically, that there are no connecting types between the orders now in existence. He regards Dohrn's Eugereon as a synthetic type, but not Scudder's Atocina, Homothetidæ, Xenoneuridæ, Palæopterina, Hemeristina, or Goldenberg's Palæodictyoptera, which he considers as belonging to existing orders, remarking that "the collection of oldest known insects consists of genuine Orthoptera (Blattidæ, Phasmidæ, Mantidæ); of amphibiotic Orthoptera (Odonata and indeed, perhaps, Gomphidæ, which were related to Stenophlebia, in the Devonian), genuine Neuroptera (Sialidæ in the Devonian), and Rhynchota (Fulgoridæ), which differ only generically from the forms now living; or even, taking into account the more general generic characters, belonging to forms now living."

Brauer, after further suggestive remarks on the relations of the fossil insects to the existing orders, maintains that there are too

few orders of insects generally recognized. While 2300 species of mammals are distributed into sixteen orders, the more than 200,000 species of insects are placed in eight or nine orders. He also criticises the too brief descriptions of our orders of insects usually given. He divides the insects (Hexapoda) into two classes[1] *Apterygogenea* (Synaptera of Packard), which is opposed to all the other insects which he calls *Pterygogenea;* the latter class he divides into six superorders and the latter into sixteen orders, which are described at length.

The six superorders are as follows, beginning with the lowest:

1. Orthoptera (in the wider sense of authors and of Gerstaecker).
2. Thysanoptera.
3. Rhynchota.
4. Petanoptera (Neuroptera, Panorpatæ, Trichoptera, Lepidoptera, Diptera and Siphonaptera).
5. Coleoptera.
6. Hymenoptera.

The sixteen orders are as follows, beginning with the lowest:

1. Dermaptera.
2. Ephemeridæ.
3. Odonata.
4. Plecoptera (Perlariæ).
5. Orthoptera (Blattidæ, Mantidæ, Phasmidæ and Saltatoria).
6. Corrodentia (Mallophaga, Atropina, Psocidæ and Termitidæ).
7. Thysanoptera (Thripsidæ).
8. Rhynchota (Hemiptera).
9. Neuroptera sensu str. (Megaloptera and Sialidæ).
10. Panorpatæ.
11. Trichoptera.
12. Lepidoptera.
13. Diptera.
14. Siphonaptera (Aphaniptera).
15. Coleoptera.
16. Hymenoptera.

Space forbids any farther abstract of Brauer's important paper, or offering any criticisms. We are, however, by no means opposed to the dismemberment of the Pseudoneuroptera, and are inclined, with Brauer, to recognize the Panorpatæ as a group of equal importance with the Trichoptera. We are also impressed with the belief that the orders of insects are more numerous than usually accepted.—*A. S. Packard.*

Histology and Embryology of Insects.—The investigations of M. Weismann upon the changes which take place in the pupa state of insects are well known. M. Viallanes has followed in the same path, and a recent issue of the *Revue Scientifique* has

[1] Saussure's Hemimerus is regarded as unlike all other insects in possessing four and not three pairs of jaws, and "must form a new class."

given us a résumé of his memoir. He first studied the tissues of the larva and of the imago, and then followed out the mode of destruction of the larval tissues and the mode of genesis of those of the perfect insect. In his researches upon the nervous system of insects he found that besides the ganglionic chain and the stomato-gastric system, certain insects possessed nervous ganglia under the integuments, in some cases distributed without apparent order, but in others grouped symmetrically and connected with the principal centers. Another discovery was, that the sensitive nerves, when they arrive immediately below the hypoderm, enlarge into multipolar ganglionic cells, which anastomose in such a way as to form a rich subcutaneous plexus, the final branches of which end by free extremities under the hypodermic cells. Thus every part of the tegument has general sensibility. It has long been recognized that some of the hairs, or hollow conical outgrowths of the chitinous cuticle secreted by the hypoderm, were special organs of touch, and were accompanied by a nerve which formed a ganglionic bipolar enlargement. M. Viallanes has proved that the hair is secreted by a specially modified hypodermic cell, and that in the protoplasm of this cell the terminal prolongation of the bipolar nervous cell ends. The dorsal vessel of an insect is formed of a single layer of cells, but each cell is contractile through the presence in it of striated muscular microscopic fibrils. Each of these fibrils begins and ends in a small disc. A theory, generally admitted, holds that the active unity of a muscular fibril must be the space between two small discs, but this is the first verification of the theory.

The voluntary muscles of vertebrates exhibit little variety even in different zoölogical groups, and in any species have the same structure throughout. But in insects the motor muscles of the wings differ from those of the legs, and the contractile tissue of the larva from that of the adult. In the muscles of the wings of a fly the fibers (faisceaux) have no sarcolemma and only a few fibrils (colonnettes); in those of the wing of Dytiscus the fibers have no sarcolemma and only a single colonette or fibril, while in those of the legs the single fiber is enveloped in a sarcolemma. The ultimate elements, however, are the same in all. Previous histologists had proved that the motor nerves of the muscles of the legs of insects separate into their constituent fibrils immediately after penetrating the sarcolemma, but M. Viallanes shows that in insect muscles consisting of several fibers the nerve branches like a tree, as it does in vertebrates, while it separates at once into its constituent fibrils in muscles formed of but one fiber.

The second part of the memoir of M. Viallanes treats of the destruction of the larval tissues. M. Weismann had proved that the muscles, tracheæ, adipose bodies and peripheric nerves of the larva disappear entirely during the metamorphosis. M. Viallanes

finds that while some muscular fibers simply degenerate and are dissolved in the cavitary fluid, others change into cells which proliferate elements resembling the vitelline granules of birds and reptiles. These multiply exceedingly, the contractile substance disappears before them, and finally they disperse in the general cavity of the nymph. The tracheæ and salivary glands become filled with embryonic cells till the whole organ becomes embryonic, and its elements finally separate and disperse in the general cavity. The whole process is similar in its nature to the breaking down of vertebrate tissue in the morbid process known as inflammation.

The third part deals with the genesis of new tissues. It is singular that the integuments of the adult are not in any way derived from those of the larva. It was previously known that the larva contains within its body certain small white bodies disposed in pairs, and destined to form the head and thorax. The anterior pair are those of the head, while three superior and three inferior pairs in the following segments are those of the thorax, wings and legs. M. Viallanes has proved that the teguments of the abdomen are also formed from imaginal discs, but these abdominal discs are produced during the metamorphosis.

Each muscular fiber or bundle of fibrils is derived from numerous embryonic cells plunged in a homogeneous intercellular substance. The cells become the muscular nuclei, while the intercellular tissue becomes fibrillose and contractile.

The work ends in a detailed account of the development of the eyes. The eye of an insect consists of three regions: (1) The compound external facetted eye; (2) the ganglionic disc which forms a sort of screen between brain and eye; and (3) the optic ganglion which is the most external enlargement of the cerebral ganglion. M. Viallanes has traced the conducting nerve from an elementary eye or facet of the external eye, through the successive ganglia to the interior of the brain itself; and he shows that the germs of all the parts which enter into the visual apparatus exist in the young larva, enclosed within the brain, which they afterwards leave to take on their definitive form and occupy their destined position.

Horn on the Anisotomini.—Dr. Horn remarks (Entomologica Americana, Vol. I, No. 3, 1885): In the genus Scotocryptus the tarsi on all the feet are three-jointed. To this character Dr. Sharp attributes considerable value, and makes it the sole groundwork for the separation of a tribe which he places between the Anisotomini and Cholevini. From my own studies this numerical reduction of the several joints is only another step in the direction so plainly indicated in the genera already known. In order that the idea may be more readily grasped, the genera may

be disposed in the following order, the numbers referring to the tarsal joints:

Triarthron	5—5—5, ♂ ♀.	Amphicyllis	5—5—4, ♂.
Stereus	5—5—5, ♂♀.		5—4—4, ♀.
Hydnobius	5—5—5, ♂♀.	Agathidium	5—5—4, ♂.
Dietta	5—5—5, ♂ ?..		5—4—4, ♀.
Anogdus	5—5—4, ♂♀.		4—4—4, ♀.
Anisotoma	5—5—4, ♂♀.	Agaricophagus	4—3—3, ♂ ♀.
Colenis	5—5—4, ♂♀.	Aglyptus	4—3—3, ♂.
Cyrtusa	5—5—4, ♂♀.		3—3—3, ♀.
Isoplastus	5—5—4, ♂.	Scotocryptus	3—3—3, ♂ ♀.
	5—4—4, ♀.		
Liodes	5—5—4, ♂.		
	5—4—4, ♀.		

In a study of the above arrangement it will be seen that Scotocryptus follows naturally the course indicated by the genera which precede it. In order that the numerical combinations shall be complete, several new genera will have to be discovered, and the missing genera may be hypothetically indicated, as far as the tarsal structures, by any one whose inclinations run that way.

In the tribe Clambini the tarsi are 4–4–4 in both sexes in the genera known to me.

The antennæ of the Anisotomini exhibit a somewhat similar tendency to numerical modifications: First, by having nine or ten joints; second, by the variation of the number of joints composing the club, being either three, four or five.

ENTOMOLOGICAL NEWS.—*Entomologische Nachrichten* for August is mainly devoted to an article, by J. Schilde, on the secondary causes and relations in the markings of butterflies.——The structure of the halteres of Diptera has been studied by Mr. A. B. Lee. These organs were believed by Leydig to be organs of hearing. It appears, according to the abstract in the Journal of the Royal Microscopical Society for August, that there are two distinct organs contained in each of these structures, one an auditory organ, the other an organ of problematical function, which may be olfactory.——M. R. Zeiller describes the burrows made by the mole-cricket (*Gryllotalpa vulgaris*) in the clay soil at the bottom of a little pool of water that was sometimes nearly dry. These tracts, owing to their arrangement and the marks made on their surface by the insect in traversing its burrow, bear a striking resemblance to the impressions of certain fossil plants. They suggest a comparison with *Phymatoderma liasicum*, and present at the same time an analogy to certain impressions of conifers belonging to the genus Brachyphyllum (Jour. Roy. Mic. Soc., Aug.).——Apropos of the recent changes proposed in the classification of insects, by Packard, Scudder and Brauer, are the remarks of M. Preudhomme de Borre in the Comptes-rendus of the Entomological Society of Belgium for July 4.——The portion in Zittel's Handbuch der Palæontologie relating to fossil insects has been prepared by Mr. S. H. Scudder.

ZOOLOGY.

E. RAY LANKESTER'S CONTRIBUTIONS TO A KNOWLEDGE OF RHABDOPLEURA.[1]—The tube is secreted by the disk or epistome, is wholly external to the animal shut off into chambers, one for each polypide.

The polypides present a body with the disk beneath it, mouth on either side under the disk, an arm with tentacles in a double row upon it, upon the opposite side of the body from the mouth the anus, body shaped like a sack with the intestine coiled and surmounted upon a stalk placed upon the mouth side. All this was known before. Lankester, by sections, demonstrates a space between the body wall and the gut wall partially filled with tissues, probably muscular and connective, which he calls the body cavity. The existence of a body cavity had not before been shown. Also upon the lower side of the main stack of the arms, near their base, L. finds a small ciliated pupilla which he thinks may be an osphradium. The lophophoral arms he considers the genetic equivalents of the ctenidia of Mollusca.

He demonstrates for the first time a sort of cartilaginous mesoblastic skeleton supporting the arms and the contractile cord. Finds the testis, not found by Allman or Sars, a blind sack opening by a special pore; this gonad belongs to Lankester's idiodinic gonads, and is not at all a modified nephridium. Allman's statoblasts are considered by Lankester to be undeveloped buds; buds which from some debility failed to burst through the chitinous tube and mature. In the absence of information upon the embryology, the affinities of Rhabdopleura cannot be definitely spoken upon. If the disk is the homologue of the epistome of Bryozoa, then it cannot be the homologue of the molluscan foot, since its position is dorsal, not ventral, and we may consider it homologous with the mantle, as suggested by Allman.—*Henry Leslie Osborn.*

THE LARGE IGUANAS OF THE GREATER ANTILLES.—The *Iguana tuberculata* is found in the Lesser Antilles, but not in the Greater. Those of Santo Domingo and the islands north and west of it belong to the three genera Aloponotus, Metopocerus and Cyclura. Of each of the first two genera but one species is known, the *M. cornutus* and the *A. ricordii.* Both genera differ from Cyclura in possessing two rows of femoral pores on each thigh, according to Duméril and Bibron. The *A. ricordii* is from Santo Domingo. The *M. cornutus* is said to be from the same island, but the authors of the Erpetologie Generale consider this uncertain. It is certain that some large lizards having a horny tuberosity on the muzzle inhabit that island.

Cyclura, as hitherto defined, does not, in the writer's opinion, differ from Ctenosaura, the species of which inhabit Mexico

[1] Quart. Journ. Mic. Soc., 1884, p. 622.

and Central America. But a character hitherto not recognized does separate the two genera nevertheless. That is the possession, by Cyclura, of corneous combs on some of the posterior digits, specialized from the ordinary lateral scales, which have also comb-like free edges in both genera. The species of this genus known to me are thus defined:

I. Scales of muzzle all small; combs on third toe only.

Several rows of infralabial scuta; five scales on canthus rostralis; crest interrupted at rump only..... *C. carinata* Harl.

II. Large scuta on muzzle; combs on third toe only; one row of large infralabials.

Infralabials and other scuta in contact with each other and with labials; two scales on canthus rostralis; crest much interrupted at nape and rump; color uniform; *C. bæolopha* Cope.

Infralabial and other scuta separated from each other and from labials by small scales; four scales on canthus rostralis; green, with bands.... *C. nubila* Gray.

III. Large scuta on muzzle; one on middle line protuberant; combs on second and third toes; several rows of large infralabials.

Scales regular, distinct on front of body; rudimentary spinous whorls on tail; crest high, interrupted at nape and rump; black..... *C. nigerrima* Cope.

Scales very irregular, minutely granular on scapular regions; no trace of whorls on tail; crest very low, much interrupted..... *C. onchiopsis* Cope.

The *C. carinata* inhabits the Turks island, whence a specimen was brought to Philadelphia by Professor A. J. Ebell in 1868. The *C. nubila* is Cuban. It is the *C. harlani* of De la Sagra's history of that island. The *C. bæolopha* is from Andros island of the Bahama group (see Proceedings of Academy Philada., 1861, p. 123). The *C. nigerrima* is a new species from Navassa, Id., of which a full description will shortly appear in the Proceedings of the American Philosophical Society. It is allied to the *Metopocerus cornutus*. The *C. onchiopsis* is also new to science, and is represented by a large specimen from an unknown locality. On the summit of the muzzle are two pairs of large scuta in front of the median tuberosity, separated by granular scales. In *Metopocerus cornutus* there are said to be three pairs of these scales. This animal also differs from the *M. cornutus* in having eight superior labials; in the nasals being subround instead of triangular; in having a large instead of small symphyseal plate, and in its very low and even imperfect dorsal crest, with a wide interruption between the shoulders. In the typical specimen the temporal muscles are enormously developed, giving the profile a huge convexity behind. Strong longitudinal and transverse gular folds. Color dirty black. The very minute scales anteriorly remind one of the *Aloponotus ricordii*.

From the stomach I took several caudal vertebræ of a mammal as large as a porcupine, and skins of fruits.—*E. D. Cope.*

M. Paul Albrecht's Identifications.—M. Paul Albrecht, in a series of articles, makes some startling identifications of homol-

ogy between parts of the mammalian skull and elements present in the lower vertebrates.

By a course of reasoning based upon the examination of skulls in which ossification was defective at some point or other, this anatomist has found the quadrate bone of reptiles to be present in mammals in its normal position, but to synostose with the squamosal early in life; he has found the symplectic of the fish in the malleus of the mammal; he identifies the piscean hyomandibular with the incus, os orbiculare and stapes, basing his identification on an actual division of the columella which is known to occur; he finds the metapterygoid transformed into the squamosal; while he sees the ectopterygoid of the fish in the mammalian alisphenoid, the entopterygoid in the pterygoid and the preoperculum in the tympanic bones.

MM. Serres, Rambaad, Renault and Ihering agree in homologizing the postfrontal with the external orbital hypophysis of mammals, and M. Albrecht agrees in the identification.

In a communication relating to the "epipituitary spondylocenters of the skull" he traces the remains of the primitive passage of the dorsal chord through the series of vertebræ which form the basicranium. After leaving the basiotic part of the occipital, the passage, according to M. Albrecht, continues *above* the hypophysis in the clivus (dorsum sellæ) of the basipostsphenoid, and thence through the basipresphenoid, basiethmoid and basirhinoid or cartilage of the nose. M. Albrecht speaks of an adult mammal in which this basirhinoid was traversed throughout its whole length by the chorda dorsalis. In some cases (*Rhinoceros tichorhinus*) it may ossify as one bone, in others as a series of centers of vertebræ. Between these bones (craniostyle Albrecht) and the atlas our author counts seven vertebral centers, namely (counting backwards from the basiethmoid), the basipresphenoid, *basihypersphenoid*, *basianasphenoid*, *basiepisphenoid*, *basiorthosphenoid*, basiotic and basioccipital. The dismemberment of the basisphenoid into the four bones the names of which are italicised, is deduced from peculiarities found in certain mammalian skulls. Another result of this course of reasoning is the homologizing of the teleostean parasphenoid with that part of the basipostsphenoid which is not included in the clivus, and another that the trigeminal nerve of the Mammalia leaves the true cranium at the same spot which it pierces in the non-mammalian gnathostomes. A profile of the head of a fish is placed above a schematic figure of the lower jaw and temporal bone of an infant to show the perfect correspondence of the connections of the meta- and ectopterygoid bones with the alisphenoid and squamosal, and of the quadrate with the lower part of the same temporal. The symplectic and hyomandibular have, according to our author (Sur la valeur morphologique de la trompe d'Eustache) nothing to do with the hyoid arch. The mere fact that the

symplectic gives origin to the cartilage of Meckel shows that it must belong to the mandibular arch. Besides this, the hyoid arch, in the rays, is attached behind these bones. The relations of the hyoid and mandibular arches to each other are traced through the various classes, and M. Albrecht maintains that the metapterygoid (squamosal), quadrate (quadrate part of temporal), ectopterygoid (alisphenoid), entopterygoid (pterygoid) and palatines form a premandibular visceral arch or rib. From this it follows that the spiracles (of selachians) and the eustachean tube are morphologically a premandibular branchial sac. Such branchiæ, in fact, exist in the spiracles of selachians.

M. Albrecht has recently returned to the attack in the *Biologischen Centralblatt*, in which (IV Band, Nr 23) he endeavors to prove from Fig. 308 of Kolliker's Entwicklungsgeschichte des Menschen und der hoheren Thiere, the correctness of his belief in the non-existence of Rathke's pouch. In the same periodical, (V Band, Nr 5 and 6) he records the discovery of seven bony vertebral centers in the cartilaginous nasal septum of a full-grown cow. His figures certainly shows seven small bones, in so far approximating an anterior tail.

In some observations recently made by our author before the Brussels Anthropological Society he treats of the posterior termination of man's vertebral column. Man, he says, is a tailless lower ape or lemur. Atavisms going back to the lemurs are more common in man than in any monkey. Through want of use he has lost "that registrar of the state of the mind," the tail. Yet man has really six or seven caudal vertebræ, two anchylosed with the three sacral vertebræ which enter into the sacro-iliac articulation, and four or five (in woman often five) coccygeal vertebræ. M. Albrecht maintains that post-coccygeal proto-vertebræ exist in some cases, and even believes in the occurrence of bone in the same region.

In another article our author gives figures of the manubria of six examples of Mycetes. In one only is the manubrium entire, and M. Albrecht correlates the fissured manubrium with the howling habit of this genus, necessitating space for the larynx.

In a memoir with the title, Intercostal Copulæ, Professor P. Albrecht reasons out and illustrates with diagrams and representations, the method of union between the paired processes of the vertebræ and the mode of origin of the sternal segments. He divides these processes into ribs (costæ) and costoids. The ribs are intermyocommatic, the costoids are interprotovertebral. The dorsal costoids are styled diacostoids; the ventral costoids, paracostoids. These costoids have their own center of ossification; when this is not the case they are replaced by di- and par-apophyses. Any adjacent pairs of ribs or costoids upon the same side may be conceived to unite while still cartilaginous. These two opposite pairs may unite. Osseous tissue may develop in each

copula. This finally results in a sternebra which is intercostal, or intermediate between two successive pairs of ribs. A succession of these intercostal copulæ between the true ribs form a sternum. Just as the true ribs are linked by copulæ that are intermediate between two adjacent pairs, so are the costoids linked by intermediate copulæ, which may thus be distinguished as intercostoidal paracopulæ and diacopulæ. These par- and diacopulæ may develop between par- and diapophyses as well as between par- and diacostoids.

The views of M. Albrecht with regard to the evolution of what may be termed rib-junctions appear very plausible, but he coins some terrific polysyllables to explain their co-relations, as witness "diparatetradiacopulaire." This is worthy of organic chemistry.

Presence of a Tail in the Human Embryo.—Does the human embryo ever present at the posterior extremity of its body anything which deserves the name of a *tail?* This question has given rise to a debate which has not failed to be a lively one because necessary distinctions had not been made by the disputants, and because they did not confine themselves to a strict definition of terms.

It is at the outset necessary to distinguish between teratological cases and normal embryological phenomena; then it is necessary to agree as to the meaning of the word *tail.* Is this term applicable to any conical or cylindro-conical appendage of the posterior extremity of the back, formed of the tissues composing it, or should we reserve it for an organ containing a prolongation of the vertebral column? It is this last definition which should prevail; an appendage deprived of vertebræ is not a true tail in the anatomical sense of the word, but a simple caudal prolongation.

In the teratological cases described by MM. L. Gerlach, Bartels and Ornstein, the appendage, sometimes filiform, sometimes voluminous, does not contain an incontestible vertebra, and the total number of these osseous pieces does not pass beyond the regular number of normal man.

As regards young embryos it is impossible to decide the question if at the outset we do not determine the point where the caudal vertebræ begin. Should we place the limit at the point where the tail leaves the body? or should we be guided by the position of the anus? or better still should we call *caudals* all the vertebræ situated behind the sacrum? It is this last view which has prevailed in comparative anatomy, and we can say from this point of view that adult man possesses a tail, since it presents four or five coccygeal vertebræ situated behind the sacrum. The minimum, in this relation, is attained by the chimpanzee, which has only two or three coccygeal vertebræ.

Should we wish to apply the name of tail to the portion of the

vertebral column situated behind the trunk, it would be necessary to bear in mind that from the age of three weeks and up to that of two months and onwards, the human embryo is fortified with this organ, because at this epoch the coccygeal vertebræ occupy the axis of a very distinct cylindrico-conical appendage, and which arises from the posterior extremity of the trunk. If, with M. His, we take for our guide the position of the anus, the tail will be shorter, but it will not cease to be very apparent, especially at the age of five or six weeks.

However, it is admitted as absolutely demonstrated, that this caudal appendage of the human embryo never contains any other vertebræ than those which are found in the coccyx of the adult. Ecker, who has given, with conviction, the name of tail to the posterior extremity of the human embryo, has declared that he has never met with supernumerary vertebræ. This author has himself studied the tail, very well formed, of a human embryo of 9^{mm} in length, and he describes and figures all the terminal part as constituted of an unformed blastema. M. His found there, however, a prolongation of the dorsal cord and spinal marrow, but no segmentation. Both admit that beyond the thirty-third or thirty-fourth vertebra there is no other portion of the skeleton. On this capital point my researches have led me to a result diametrically opposed to that of my predecessors. The errors of M. His arose from the fact that the embryos, the more advanced of which he made the reconstruction, those of 7^{mm} and a fraction, have precisely thirty-four myomeres, viz., thirty-three vertebræ, and he admits, without any other proof, that he was working over a definite stage.

I have had the honor of presenting to the academy a résumé of my anatomical study of a human embryo of $5\frac{6}{10}^{mm}$, viz., one twenty-five days old. This embryo had no more than thirty-three somites, representing thirty-two vertebræ. There is then an increase of the number during the fourth week. This fact led me to seek whether this number might not increase still more during the fifth week, and my attempt did not fail! The human embryo of 9^{mm} to 10^{mm}, the age when the tail reaches its maximum length, *possesses a number of vertebræ greater than that of the adult.*

Two embryos of better appearance and perfectly fresh at the moment when they were sent me, have been photographed, and then treated with reagents and cut into microscopic sections. The series of sections are irreproachable, and one of the two sets, comprising 320 sections, has been entirely drawn, with the greatest pains, with the camera lucida. In comparing these 320 drawings it is easy to count, without any chance of error: 1st, the rachidian ganglion; 2d, the myomeres; 3d, the cartilages arising from the bodies of the vertebræ. These three counts control and mutually confirm each other, since all three give the same result, the human embryo of 8 to 9^{mm} has thirty-eight vertebræ.

This result is also confirmed by the examination of photographs of fresh pieces, for then can be easily distinguished thirty-five myomeres and, besides, a region occupying the outer fourth of the tail, where the limits are no more visible across the skin. But the sections prove to us that in this last quarter, contrary to the opinion of Ecker and of M. His, the mesoderm is divided with the greatest clearness into a double series of somites which extend to the last extremity of the tail, but presenting, it is true, dimensions regularly decreasing up to the thirty-eighth somite, which does not measure more than thirty-seven microns in diameter.

This fact is in no way teratological; it is plainly confirmed by several other embryos which I possess, all perfectly normal and of ages slightly different.

With the exception of the two last, all the caudal vertebræ have a blastema of a cartilaginous body similar, except in its dimensions, to that of any other vertebra of the series. The two last are only indicated by myomeres, perfectly distinct from the rest. The extremity even of the tail is formed by the termination of the medullary tube, only covered by the skin. The dorsal cord also extends very near this extremity.

The last caudal vertebræ have only a very ephemeral existence; already in embryos of 12^{mm} in length, viz., six weeks old, the thirth-eighth, thirty-seventh and thirty-sixth vertebræ become confounded in a single mass, and the thirty-fifth itself is not perfectly limited. An embryo 19^{mm} in length has no more than thirty-four vertebræ, the thirty-fourth evidently resulting from the fusion of the last four; at this period the tail as a whole is already much less prominent.

It results from these facts that the human embryo during the fifth and sixth week of its development, is provided with an undoubted normal tail which in form is regularly conical, elongated and which deserves, under all relations, the name which I have given it. This organ, evidently deprived of all physiological utility, should be classed in the number of representative organs. —*Professor H. Fol, in Comptes Rendus de l'Acad. Francaise, June 8, 1885.*

Zoological News.—*Echinoderms.*—Professor. F. J. Bell (Proc. Zoöl. Soc., Dec. 18, 1883) describes *Anomalanthus lumidus*, a species of echinoid first described by the Rev. J. E. T. Woods as an Echinanthus. As the ambulacral pores are arranged in rows which are not closed or quite parallel, and which show a tendency to spread at their distal end, and as the under surface, though with the ambulacral sutures of Echinanthus, has not those sutures converted into conspicuous grooves, Professor Bell makes it the type of a new genus. It is found upon the eastern coast of Australia.——As one of a series of contributions to the systematic arrangement of the Asteroidea, Professor F. J. Bell (Proc. Zoöl.

Soc. London, 1884) gives a monograph of the genus Oreaster. He allows twenty-seven species, including *Nidorellia armata* of Gray, and gives a full description of each, with habitat, etc.

Mollusks.—Dr. Gwyn Jeffreys (P. Z. S) describes seventy-four species of Littorinidæ, Scalaridæ, etc., gathered by the *Lightning* and *Porcupine* expeditions. A large proportion are new.—— Professor B. Sharp, in an address before the Biological section of the Academy of Natural Sciences of Philadelphia, gives the following as the development of the molluscan eye: (1) A pigmental surface of epithelial cells, as in Ostrea; (2) pigmented invaginated grooves for protection at centralized points of the body, each visual, all having a cuticular body, as in *Solen vagina* and *S. ensis;* (3) a sphere made of pigmented cells, the sphere formed by the contraction of the groove, as in Patella; (4) a cuticular lens formed by the centralization of the refractive bodies of each cell, as in Haliotis and Fissurella. In both these genera there is a distinct nerve of sight connected with the superior cephalic ganglion.——Mr. Chas. E. Beecher (36th report N. Y. State Mus. Nat. Hist.) describes some abnormal and pathologic forms of fresh-water shells. He figures a sinistral *Planorbis exacutus*, which is monstrous in every particular, and another with an expanded aperture, also abnormal examples of *Physa ancillaria*, *Valvata tricarinata*, *Gillia altilis*, *Somatogyrus subglobosus*, *Unio pressus*, *cariosus* and *complanatus.*——Professor B. Sharp maintains that the lens of the eye of the Vertebrata is homologous with a primitive invaginated eye, such as we now find in the Gastropoda, and that the layer of optic fibers of the retina is homologous with the primitive optic nerve. If the lens is the sphere of the mollusk, and the fibers of the retina the primitive optic nerve, the retina or ganglion opticum must be regarded as formed by an outgrowth of the brain, and the optic nerve of the vertebrate is really a secondary optic nerve.

Fishes.—Mr. W. R. O. Grant (Proc. Zoöl. Soc., 1884), contributes a revision of the fishes of the genera Sicydium and Lentipes. The first genus occurs throughout the torrid zone in fresh waters near the sea, and contains twenty-four species, five of them new to science. Lentipes occurs in the rivers of the Sandwich islands, and equals Sicyogaster Gill. Two species are known.

Reptiles.—Professor W. K. Parker (Trans. Zoöl. Soc. London, 1883), in his account of the structure and development of the skull in the Crocodilia, remarks that the skull of the Sauropsida is a mere specialization of the underlying ichthyic type. He considers that in some very important things the skull of the anurous Amphibia forms a better leading step to the mammal than that of the Sauropsida. The Crocodilia show in the earliest stage a compound nasal labyrinth. Only three of the visceral arches are developed, and only the first attains full size. In embryos from one and five-

sixths to three and one-half inches long the whole of the chondrocranium, with its visceral arches, has become sauropsidan, and the investing bones are quite crocodilian in number and relation. The chondrocranium is better developed than in any existing reptile or bird. The mandibular arch in the crocodile is the culmination of the oviparous type. In the early stages the mandibular suspensorium is extremely like that of the more generalized selachians. There is a distinct suprastapedial element in the hyoid arch.

Birds.—The "cape wigeon" of Latham, and *Anas capensis* of Gmelin, is noted by T. Salvadori as occurring in Shoa. It is redescribed as *Querquedula capensis.*——Mr. R. B. Sharpe describes an apparently new nuthatch (*Sitta whiteheadi*) from the mountains of Corsica.

EMBRYOLOGY.[1]

On the Genesis of the extra terminal Phalanges in the Cetacea.[2]—In what manner the extra terminal phalanges of the second, third and fourth digits of the manus of such a type as Globiocephalus amongst Cetaceans, was evolved, has been a question which my studies gave little hope of satisfactorily answering until I had noticed that the bony digits of both the manus and pes in the pinnipeds are prolonged into the flat terminal integuments of the limbs far beyond the nails as unsegmented bars of cartilage, which are really unossified extensions of the ungual phalanges. The nails are borne upon the dorsal aspect of the ungual phalanges in pinnipeds, the ossified shafts of these phalanges usually ending abruptly to be continued into the terminal bars of cartilage. In Histriophoca the terminal cartilaginous extension of the last joints of the digits are quite rudimentary, but the point where the ungual phalanges abut distally upon the terminal cartilages is still visibly marked in this species. In the walrus, the fur-seal and sea-lion the terminal cartilages of the digits are more developed, and articulate directly with the abruptly truncated ends of the ungual phalanges. In the manatee the ungual phalanges of the manus terminate abruptly; that they support cartilaginous extensions of notable length seems improbable. The terminal cartilages of the digit apparently reach their greatest or strongest development in the walrus.

The foregoing data when interpreted by the aid of embryological theory, as actually observed to hold in other forms, and linked with the explanations afforded by other facts which will be given later on, will, it seems to the writer, gives us a rational hypothesis of the origin of the extra-terminal digits in the manus of the whales.

[1] Edited by John A. Ryder, Smithsonian Institution, Washington, D. C.

[2] This note presents the substance of conclusions reached by me in my memoir entitled, "On the development of the Cetacea, together with a consideration of the probable homologies of the flukes of cetaceans and sirenians," now in press.

That the digits of the Cetacea develop as part of the continuous blastema of the embryonic appendicular skeleton as in other vertebrated animals, there can be no doubt. That the joints and segments of their limbs also become gradually defined in serial order from the shoulder and hip girdles outward, also admits of no doubt, as may be seen upon studying sections of the manus, a quarter inch in length, of a fœtal Globiocephalus two inches in total length. In like manner there can be no doubt of the fact that the cartilaginous extensions of the ungual phalanges of pinnipeds are a part of the original blastema from which the ossified portions of the skeleton of the limbs of these animals has developed.

In man the shafts of the three phalangeal segments of the digits of the manus ossify almost contemporaneously. In Globiocephalus, on the other hand, in a specimen one-third grown, it is found that the proximal segments of the second and third digits ossify apparently at about the same time as their isomeres in the first, fourth and fifth digits, whereas the distal or *extra* peripheral segments develop ossific centers enchrondrally much later. These data, therefore, indicate that the extra terminal phalangeal segments of the Cetacea have been added to the digits of the manus since the three proximal ones have been formed, which are normally characteristic of the digits of other mammals.

In fact, the development of the manus of Globiocephalus shows that while the metacarpal elements and first three or four phalangeal segments of the second and third digits ossify simultaneously, the four to six extra distal segments ossify in succession towards the distal periphery, the terminal elements of the digits being the last in which ossific centers appear.

Granted, then, that the extra terminal digital segments of the whales are ontogenetically as well as phyletically of later origin than the proximal ones, the only source from which it is possible to conceive them to have been derived is from such cartilaginous extensions of the ungual phalanges of some ancestral seal-like form, or from the cartilaginous extensions of the digits of the Protocetacea, which may for our purpose, be considered to represent a hypothetical type. These cartilaginous extensions, if segmented a number of times, would afford the basis for the development and ossification of the extra terminal digits of the existing whales. In fact, in some of the existing seals these cartilaginous prolongations of the ungual phalanges are long enough in the pes to afford the basis for three new and additional segments to each digit, as long as the three normally developed in each toe.

The proof that the extra terminal segments of the digits of the cetacean manus have been added distally, is the fact that the structure of the carpus is not, in any essential feature, different in structure from that of other mammals so far as the presence or

absence of elements normally formed is concerned. I am therefore constrained to believe that it has been through a seal-like ancestry with prolonged integuments to the manus, in which the nails were not terminal but dorsal, beyond which the ungual phalanges were extended as bars of cartilage, which gave rise, by transverse segmentation and subsequent ossification to extra terminal digital segments as found in existing Cetacea.

The second fact of importance to be considered as lending probability to the foregoing view is the circumstance that when a limb is in its primitive cartilaginous condition it always develops its segments from its axial end toward its peripheral end in serial order. The basis for the extra terminal segments was first developed through the influence of functional adaptation, as cartilaginous bars or extensions of the primitive cartilage of the ungual elements of the digits in response to the demands made upon the limb in swimming. The segmentation of these terminal cartilaginous bars then followed through the influence of mechanical strains acting upon the cartilaginous terminal bars as the were alternately bent in opposite directions. These conclusions might be still further illustrated by data obtained from the observation of the development of the limbs of other animals.

These views, very forcibly it seems to me, sustain the hypothesis that the Cetacea are the off-shoots of land forms which were at first terrestrial, or at least amphibious, as are the pinnipeds. Such views do not at least run counter to any morphological facts, but in reality are sustained by them.—*John A. Ryder.*

On the Manner in which the Cavity of the Heart is formed in certain Teleosts.— Balfour (Comp. Embryol., II, 523) states that "in Teleostei the heart is formed as in birds and mammals by the coalescence of two tubes, and it arises before the formation of the throat." I would now point out that this is not universally true of all teleostean forms, in fact it seems not to be the mode of cardiac development in any species of this group so far investigated.

My own observations on this point have been made upon the embryo cod-fish,[1] and indicate very conclusively, so far as transparent views are of value in deciding such a difficult matter, that the lumen of the heart arises as a single and not as a double cavity which afterwards blends to form a single one, as in birds and Mammalia. Moreover, this cavity is from the first open below, and is present in the cod embryo, on the fifteenth day, as a round opening limited all round by mesoblastic cells. Its transverse diameter at this stage is .043$^{mm.}$ and is probably half as deep. It has the appearance of a round perforation in the mesoblastic plate of cells which probably gives rise to the endothelium of the cardiac cavity, the lining of the pericardial cavity and

[1] Contrib. Embryog. Oss. Fishes, pp. 82–86.

muscular wall of the heart, and which underlies the fore-gut as a transverse band of tissue. The cardiac lumen, as observed by myself to appear in the living embryo, occupies, *ab initio*, such a position that the median vertical plane passing through the embryo lengthwise would divide it.

Its floor, which corresponds to its future venous end, seems to be devoid of cells, and is formed apparently by the periblast covering the yolk. In the later stages of cardiac development in forms which have no complete circulation at the time of hatching, this is invariably the case, the venous end of the heart opening directly upon the surface of the periblast, as is shown in longitudinal sections of such stages.

As elsewhere stated, the yolk is here absolutely excluded from the intestine, and the arrangement above described then provides the passage-way for yolk material into the general circulation as it is segmented off from the periblast, as shown by Kupffer, Gensch and myself. This also bring the segmentation cavity and the blood vascular channels into actual continuity.

The investigations of Hoffmann[1] upon the development of the heart in Salmo are based entirely on sections, and begin with a stage long prior to the time when the organ begins to pulsate, and corresponds pretty closely to the stage of development seen in the cod embryo described above, which was observed about two days before pulsation began, when the heart became for the first time distinctly tubular, its lumen in the early stage here considered, being a mere flat, discoidal vacuole with vertical side-walls formed of cells. At a later stage of development the axis of the lumen of the cardiac cavity is horizontal instead of vertical.

Hoffman concludes that the endothelium of the heart is derived from the hypoblast, in which a short tubular cavity at once appears, the long axis of this endothelial tube coinciding in direction with the axis of the embryo. The myocardium or muscular outer wall of the heart is derived from the splanchnopleural plates which grow on either side of the embryo from above downwards and inward under the fore-gut, below which they approximate, their free ends finally investing the endothelial vesicle or tube, which represents in the salmon the vacuole above described in the cod embryo, which is the first trace of the cardiac lumen. After the muscular layer of the heart is supplied by the splanchnopleural plates, the foundation of the structure of the adult heart has been laid.

In neither of the foregoing accounts is there anything which suggests very much similarity between the mode of development of the first traces of the unpaired rudiment of the teleostean heart and that of Aves or Mammalia which arises by the fusion in the median line of a pair of cavities on either side of the lat-

[1] Zur Ontogenie der Knochenfische, Pts. VII, VIII. Amsterdam, 1882.

ter, which are for a time shut off from each other by a septum.—*John A. Ryder.*

PSYCHOLOGY.

CURIOSITY OF MONKEYS.—"Do monkeys learn by experience?" is asked in your last number by Mr. W. H. Frost, who cites cats as learning in regard to their reflection in a mirror, and further states that it is claimed, on tolerable good authority, that monkeys never do, which statement he does not attempt to answer.

It seems to me that the probable explanation of the difference of action of the two animals in the matter is due, not to the superior powers of discernment, and capacity of learning by experience possessed by the cat, as one would infer from the article mentioned, but just the reverse.

I should doubt very much but that the monkey realizes in time that there is no other individual behind the glass, and think that its actions are simply due to the greater mental development which it possesses, and which is largely manifested by its investigative turn of mind, and could we understand the monkey language, it would tell us that it was a problem which it was trying to work out, and that while it felt that it was no genuine or ordinary monkey which appeared in the glass, it was curious to find out just what it was.

The monkey's mind, from long experience, has an innate consciousness of power to solve many of the problems presented to it, and being in a comparatively active state of evolution, is continually grasping out at new ideas.

The cat's mind, on the other hand, is not of such a progressive type, and consequently it quietly gives up many problems with "I cannot comprehend," and ceases to "bother its head about it," simply accepting the problem as it appears to it—a harmless, unexplainable phenomenon.—*Eugene N. S. Ringueberg, Lockport, N. Y.*

THE INVERNESS DOG "CLYDE."—Further letters respecting the Inverness dog "Clyde" tend to increase our respect for the sagacity of that individual. Its owner asserts that he taught himself to go to the baker's shop with money, and that he does intentionally and knowingly steal, hiding the money in his mouth. He will often hide some pieces in some corner known only to himself, ready to spend on occasion. If told to raise his head he will however, do as ordered, and the donor can then put the money in the box. A particularly innocent look upon his face indicates to his owner that he has money in his mouth, but he will disgorge when commanded. On one occasion when he was ordered to come to receive the punishment due for disobedience, he sprung into the canal instead; and, on another, when told to go to the baker to get some water to drink, he brought a tin bowl out of the back room and set it down before the baker, looking at him as if to say, "Don't you see what I want?"

ANTHROPOLOGY.[1]

THE EIGHTH VOLUME OF THE TENTH CENSUS.—In this ponderous quarto are four papers with different pagination, to wit: Newspapers and periodicals; Alaska; Fur Seal islands, and Shipbuilding. We are here concerned with the third, which bears the title, Report on the population, industries and resources of Alaska, by Ivan Petroff, special agent, pp. 190. The following named maps interest the ethnologist: Ethnological map of Alaska, maps showing distribution of fur animals and timber. Six colored plates illustrate the social life of the people.

For the purpose of enumeration and description the Territory is considered in the following six divisions:

1. The Arctic division. Arctic watershed east of C. Prince of Wales.
2. Yukon division. Valley of the Yukon river.
3. The Kuskokvim division. Valleys of the Kuskokvim, Togiak and Nushegak rivers.
4. The Aleutian division. Aliaska peninsula west of the isthmus, between Moller and Zakharof bays and the chain from Shumagrin to Attor, including the Pribylof, or Fur Seal islands.
5. The Kadiak division. South coast of Aliaska to Zakharof bay, Kadiak group, Cook's inlet, Kenai peninsula and Pr. Wm. sound.
6. South-eastern division. From Mt. St. Elias to Portland canal, in lat. 54° 40′.

Each one of these divisions is taken up separately, the people mentioned and located by settlements, and the population given.

In the Arctic division the people are all Eskimo, or Innuit.

In the Yukon division 4276 enumerated are Eskimo, and 2557, living on the river basin away from the sea, are of the great Tinné, or Athapaskan stock.

In the Kuskokvim division 8036 are Eskimo, 506 Athapaskan, 255 Aléut and 114 whites and creoles.

In the Aleutian division 1890 belong to the Aleutian, or Ununggan stock, 561 are whites and creoles. No Eskimo exist in this area.

In the Kadiak division 321 Thlinkit, or Kolosh Indians, 864 Athapaskans, 2211 Eskimo and 951 whites and creoles.

In the South-eastern division 788 are Haida, or Queen Charlotte stock, 6437 Thlinkit, 523 whites and creoles. The Thlinkit stock of this division includes the tribes called Chilkhat, Hunyah, Khutz-na-hu, Kehk, Auk, Taku, Stakhin, Prince of Wales, Tongas, Sitka, Yakutat. The Haida tribes of this division all live on Prince of Wales island.

Although the author has a chapter on Alaskan ethnology (123–177) replete with information upon the social life and arts of the people, every other portion of the monograph abounds with invaluable matter. Indeed, there would be no hesitation in saying that this chapter of the census will remain for a long time an ethnologic text-book on Alaska.

[1] Edited by Prof. OTIS T. MASON, National Museum, Washington, D. C.

TEXAN MOUNDS.—Mr. Pierce, Episcopalian bishop of Little Rock, Ark., states that in the old bottom of Red river, south of its present course, between Rocky Comfort, Ark., and De Kalb,[1] Texas, an extensive series of unexplored mounds can be found. When he saw these mounds, while riding by in a carriage, they appeared to him of almost uniform size and flat on the top, about sixty feet wide and eighty long, with a height varying from eight to twelve feet. They were oval with the long sides lying parallel to each other, and a portion of them projected into the brushwood, so as to be only partially visible. To state the number of these artificial structures is impossible, but it took an hours' ride before he had passed the last of them.

ANTHROPOLOGICAL COLLECTORS.—In every department of science one of the most valuable requisites is the collector. When his material is assorted and put away for research or put on exhibition for educational purposes, almost the only value which the specimens have is the little piece of paper he attaches to them. It is well known that specimens are assorted and arranged by certain classific concepts, such as locality, tribe, structure, function, and evolution. Now, suppose a collector is going over the eastern, or the western coast of North America, and from one place brings a large quantity of mortars and pestles, from another, basket work in the greatest profusion, from another, pottery, and from a fourth, bows and arrows of a pattern which he regards as unique. These are brought home and laid on tables according to the locality concept. We see at once what a chapter in human history we can write. Tribe A grinds its food, tribe B does nothing but make baskets, tribe C has no other vessels but pots, and tribe D is altogether addicted to the chase. It is impossible to say beforehand to a collector, get this or that, for we do not know what he is going to find. If we say, get everything, or at least a sample of everything, he is at a loss to decide which to select. One very good rule for a collector to follow is, *Perfect each observation.* It is better to know all about something than to know a little about everything. "Blessed is the man that's well smattered," does not apply to collections. In the case of any human art whatever, it is essential to have the raw material, together with accurate descriptions of all the customs and superstitions connected with its procurement and preparation. The next thing is to find out who are the agents, men or women? all or some? always or sometimes? everywhere or somewhere? This should be followed by the scrupulous procurement of all the tools used in all the steps from exploitation to exchange or consumption. Nor would these be very useful without photographs, models, and descriptions of all the processes involved, without, in short, exhaustively answering the

[1] Bowie county, Texas.

question *how*. Finally, the finished product of each art should be procured in all the types of its manifestation. I know one man who collects only the rudest products of each art. I know many more who are wasting fortunes on *chef d'œuvres*, and, I am proud to say, there are very many private collectors who are engaged in exhausting a special theme up to the limit of their means. In 1875 I prepared a little pamphlet for Centennial collectors in which I dwelt particularly upon this point. Some of the material procured for that great exhibit was gathered by the rule that we must have all of a thing or none. Lately some of the mound-explorers have proceeded on the same plan. But, alas, the old raking-in process is also largely in vogue, and future museum students will have a happy time in guessing what manner of people those ancients were. I have lately opened a large lot of relics from old Peruvian cemeteries, in which the transmitter says, "You will doubtless know all about these things." In emptying some of the pots and gourds I came across a large beetle, nearly two inches long, transfixed with an entomologist's pin, the latter very much rusted. Now, can any body tell me whether the Incas were so advanced in culture as to make collections of insects and to preserve them on pins exactly like those in use forty years ago?

Anthropology is fast becoming an exact science, thanks to the noble army of collectors who have known how to see, delineate, collect and describe; but there is still room for improvement. I do not mean that we must become the victims of professional collectors, The much better way is for every lover and student of this science to exercise the greatest wisdom on his own behalf, to do his own collecting as far as possible, and to submit other material to the most rigid scrutiny.

PUJAHS IN SUTLEJ VALLEY.—In nearly every Himalayan village there is a house for the representation of the local divinity. In front is a shed formed of four pillars, and a roof of wood ornamented in the style of the temple. This is both a resting place for travelers and the scene of some of the ceremonies connected with worship. In each of the temples is kept a framework (called devi) hung with pieces of silk variously colored, looking like a shrine. This is borne by staves over which a red cloth is hung, drooping to the ground on either side and covering the staves except where they rest on the bearers' shoulders. Above the level of the staves, and around the central post are masks of gold or brass. The central portion is surmounted by a mass of yak's tails dyed red. Similar forms are found in other parts of the mountains. At times the devi is taken out for an airing, when the people wash themselves and their clothes. The ceremony was a peculiar dance in the porch of the temple, during which the devi was carried round by two men facing each other. The villagers faced the litter in a semicircle, their arms intertwined. The end man

had his right hand free, and in it he held a *chowrie* (brush of yak's tails) with which he kept time. At another ceremony an old man in the red robe of a lama approached the devi, and washed the masks with mint and water, offering incense, flowers, fruit, and bread. A number of birds, some black, some white, were killed, and the blood sprinkled on the devi, afterwards the rest was dashed over the building. A part of the service was a mock battle with walnuts and pine cones, between the priest and his attendants from the balcony of the temple, and the people below. Meanwhile the birds were cooked, and they are now served, the women eating first. The devis have a way of intimating when they wish to go visiting. The reception of one devi by another is like two rajahs meeting. There is a great amount of bowing and shaking which terminates in the host getting behind and the procession marching to the village temple. When the visitor returns home the host accompanies it to the borders of the village. Mr. Simpson, who describes the pujah ceremonies first draws attention to the ark and sacrifices of the Jews and the Egyptians, and then views with more favor the car-festival as the parent of these primitive services. To most people unacquainted with India the rath yatra, or car-festival, is associated only with Jagganath, at Puri, but this is not so; cars are kept in the temples over the whole of Southern India. Although not connected with Hinduism, the Buddhists also had a similar festival. If it was common to the whole of India, it is easy to see that where there were no roads for a car on wheels, the god would have to be carried on men's shoulders, and the size would be reduced to suit circumstances. At one of the pujahs a Brahmin walked barefooted thirty steps on the sharp edges of hatchets.—*J. R. A. Soc., XVI., 13–30.*

The Kansas City Review.—One of our best sources of information respecting the archæology of the Missouri region, is the *Kansas City Review*. The editor, Mr. Theo. S. Case, has conducted this journal for seven years, at considerable expense to himself, in order to contribute his share towards the intellectual improvement of his section. There is a rumor that the *Review* is in danger of stopping through want of patronage. We regret to hear this very much. The late Dr. Ruggles said to the writer on one occasion, "I do not read half the books and magazines I buy. I take them because I am afraid the authors would suffer without my little help." Now this is one motive, and there are many more why we should not let good scientific literature languish through lack of our aid.

MICROSCOPY.[1]

Treatment of the Eggs of the Spider (*Agalena nævia*).—The eggs of our common grass spider (*Agalena nævia*) are de-

[1] Edited by Dr. C. O. Whitman, Mus. Comparative Zoology, Cambridge, Mass.

posited in white silky cocoons, which are attached to the under side of loosened bark, fence boards, and other sheltered places. They are very abundant in September and October, and during the entire winter cocoons may be found with eggs in early stages of development. This species thrives well in captivity, so that there is no difficulty in obtaining eggs freshly laid.

For studying the egg in a living condition the long-used method of immersion in oil is excellent. The oil should be perfectly clear and odorless. The external features can be studied to better advantage by mounting the eggs in alcohol after they have been freed from the chorion and stained. Another valuable method for surface study consists in clearing the already stained egg in clove oil. The thickness of the blastoderm is most easily determined in this way.

The best method of hardening preparatory to sectioning is that of heating in water to about 80° C., and then, after cooling slowly, treating with the usual grades of alcohol. Good results were obtained with Perenyi's fluid, which rendered the yolk less brittle. Osmic acid does not penetrate the chorion, and chromic acid or acid alcohol are not easily soaked out on account of the thickness of the chorion.

Borax-carmine proved, on the whole, to be the best staining fluid. It is difficult to make the dye penetrate the chorion, and, after hatching, the cuticula forms a similar obstacle. This difficulty may be overcome by prolonged immersion in the staining fluid. In some cases seventy-two hours were required to obtain a sufficient depth of color. In order to avoid maceration, which would result from so long continued immersion in a weak alcoholic dye, the staining process may be interrupted at the end of every twenty-four hours, by transferring to seventy per cent alcohol for an hour or more.

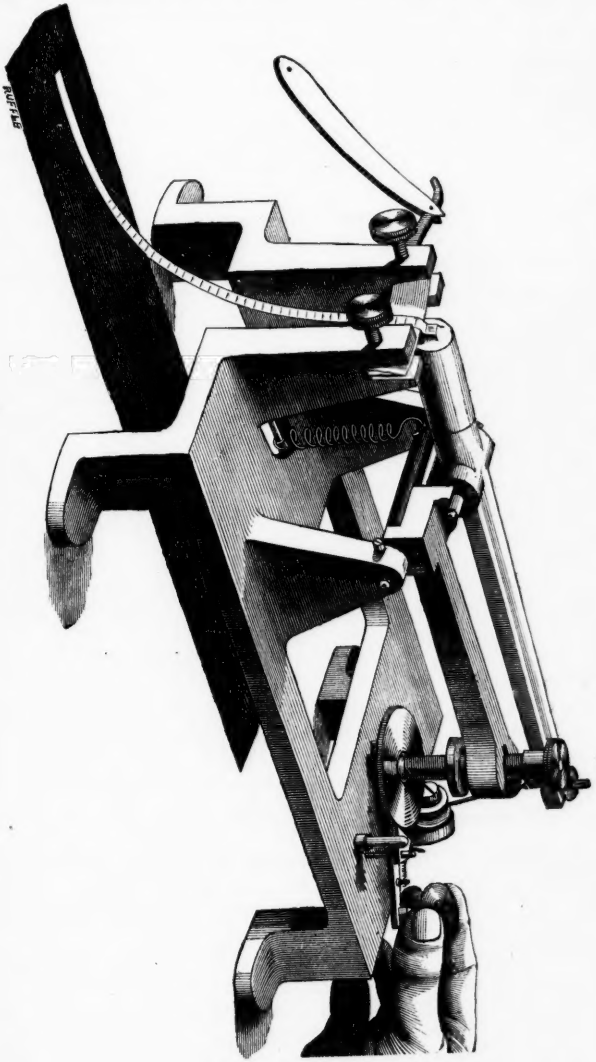
After most methods of hardening, the yolk becomes very brittle, and the sections crumble. This difficulty may be overcome by collodionizing the cut surface before making each section, in the manner described by Dr. Mark (AMER. NATURALIST, June, 1885).—*Wm. A. Locy.*

THE ROCKING MICROTOME.[1]—The Cambridge (Eng.) Scientific Instrument Company have just introduced a new type of microtome, in which the sliding movement of parts is replaced by a rotary one. The ribbon of sections falls by its own weight direct from the razor on to a sheet of paper. The instrument is simple in construction and is sold at the comparatively moderate price of $26.

The chief objection to this microtome is, that it is adapted to only one mode of section-cutting, namely, that of producing ribbons of sections imbedded in paraffine. It could not be used for

[1] Journ. Roy. Mic. Soc., June, 1885, p. 549.

cutting collodion sections, nor could it be conveniently employed in the Duval-Mason method, where the block of paraffine is col-



The Rocking Microtome.

lodionized before making each section. The position of the object is such that it can not be conveniently watched during the

process of cutting; and this appears to me to form another serious objection to the instrument.

The construction of the instrument is as follows: Two uprights are cast on the base plate of the instrument, and are provided with slots at the top, into which the razor is placed and clamped by two screws with milled heads.

The imbedded object is cemented with paraffine into a brass tube which fits tightly on to the end of a cast-iron lever. This tube can be made to slide backwards or forwards so as to bring the imbedded object near to the razor ready for adjusting. The cast-iron lever is pivoted at about three inches from the end of the tube. To the other end of this lever is attached a cord by which the motion is given and the object to be cut brought across the edge of the razor. The bearings of the pivot are V-shaped grooves which themselves form part of another pivoted system.

Immediately under the first pair of V's is another pair of inverted V's, which rest on a rod fixed to two uprights cast on the base plate. A horizontal arm projects at right angles to the plane of the two sets of V's, the whole being parts of the same casting. On the end of the horizontal arm is a boss with a hole in it, through which a screw passes freely. The bottom of the boss is turned out spherically, and into it fits a spherical nut working on the screw. The bottom of the screw rests on a pin fixed in the base plate.

It will be seen that the effect of turning the screw is to raise or lower the end of the horizontal arm, and therefore to move backwards or forwards the upper pair of V's, and with them the lever and object to be cut. The top of the screw is provided with a milled head, which may be used to adjust the object to the cutting distance.

The distance between the centers of the two pivoted systems is one inch, and the distance of the screw from the fixed rod is six and a quarter inches. The thread of the screw is twenty-five to the inch; thus if the screw is turned once round, the object to be cut will be moved forward $\frac{1}{25}$ of $\frac{1}{6\frac{1}{4}}$ or $\frac{1}{156}$ of an inch.

The turning of the screw is effected automatically as follows: A wheel with a milling on the edge is fixed to the bottom of the screw. An arm to which a pawl is attached rotates about the pin which supports the screw.

This arm is moved backwards and forwards by hand or by a cord attached to any convenient motor. When the arm is moved forward the pawl engages in the milling and turns the wheel; when the arm is moved back the pawl slips over the milling without turning the wheel. A stop acting against the pawl itself prevents any possibility of the wheel turning, by its own momentum, more than the required amount. The arm is always moved

backwards and forwards, between two stops, a definite amount, but the amount the wheel is turned is varied by an adjustable sector, which engages a pin fixed to the pawl and prevents the pawl from engaging the milling on the wheel. By adjusting the position of this sector the feed can be varied from nothing to about $\frac{5}{32}$ of a turn, and hence since the screw has twenty-five threads to the inch, the thickness of the sections cut can be varied from a minimum, depending on the perfection with which the razor is sharpened, to a maximum of $\frac{5}{32}$ of $\frac{1}{25}$ of $\frac{1}{6\frac{1}{4}}$ or $\frac{1}{1000}$ of a turn. The practical minimum thickness obtainable with a good razor is approximately $\frac{1}{40000}$ of an inch. The value of the teeth on the milled wheel are as follows:

1 tooth of the milled wheel	=	$\frac{1}{40000}$	of an inch	= .000625^{mm}
2 teeth	"	"	"	=	$\frac{1}{20000}$	"	"	= .001250^{mm}
4 "	"	"	"	=	$\frac{1}{10000}$	"	"	= .0025^{mm}
16 "	"	"	"	=	$\frac{1}{2500}$	"	"	= .01^{mm}

The movement of the lever which carries the embedded object is effected by a string attached to the end of the lever. This string passes under a pulley and is fastened to the arm carrying the pawl. Attached to the other end of the lever is a spring pulling downwards.

When the arm is moved forwards the feed takes place, the string is pulled, the embedded object is raised past the razor, and the string is stretched. When the arm is allowed to move back the spring draws the imbedded object across the edge of the razor, and the section is cut. The string is attached to the lever by a screw which allows the position of the embedded object to be adjusted so that, at the end of the forward stroke, it is only just past the edge of the razor. This is an important adjustment, as it causes the razor to commence the cut when the object is traveling slowly, and produces the most favorable conditions for the sections to adhere to each other.

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SCIENTIFIC NEWS.

— To the report of the Commissioner of Fisheries of New York in charge of the oyster investigation is appended Dr. H. J. Rice's excellent tract on the propagation and natural history of the American oyster. An account is first given of experiments carried on at Cold Spring harbor on the propagation of the oyster, and then follows notes on the distribution of the animal, the structure of its shell, the gross anatomy of the animal including the reproductive organs, succeeded by chapters on seed oysters, the food of the oyster, its coloration, its artificial propagation, the methods of obtaining spat, and the friends and enemies of the oyster. Reference is made to the supposed method of extraction

of the animal of the oyster by the star-fish; as the result of his own observations Dr. Rice was not able to decide as to the exact method or methods; he, however, inclines to the opinion that the star-fish works in more than one way, sometimes suffocating, sometimes poisoning and sometimes taking in the oyster bodily. Due credit is given to the labors of Dr. Brooks and Mr. Ryder. The report is illustrated by six plates, which add materially to our knowledge of the structure of the shell, the soft parts and the rate and mode of growth of the shell.

— An apiculture station has recently been established at Aurora, Ills., in connection with the Entomological division of the Department of Agriculture. Mr. Nelson W. McLain has been appointed to take charge of the station, and Professor Riley has instructed him to pay particular attention to the following subjects:

1st. To secure the introduction and domestication of such races of bees as are reported to possess desirable traits and characteristics; to test the claims of such races of bees as to excellence, and to prove by experiments their value to the apiculturists of the United States and their adaptation to our climate and honey-producing flora.

2d. To make experiments in the crossing and mingling of races already introduced, and such as may hereafter be imported, and by proper application of the laws of breeding endeavor to secure the type or types best adapted by habit and constitution to the uses of practical bee-keepers in the United States.

3d. To make experiments in the methods of artificial fertilization, and if possible demonstrate the best process by which the same may be accomplished.

4th. To test the various methods of preparing bees for winter —such as stimulating late breeding, removing the pollen from the hive in winter, feeding on sugar syrup, watering during long confinement, the stimulating of early breeding in spring, the control of the swarming impulse and the prevention of swarming.

5th. To gather statistics concerning the bee-keeping industry in the United States, and obtain an approximate estimate of the number of colonies of bees kept, the number of pounds of honey and wax produced in the several States and in the United States, and the value of the same.

6th. To make experiments with and observations concerning varieties of honey-producing plants for bee-forage.

7th. To study the true cause or causes of diseases yet imperfectly understood, and the best methods of preventing or curing such diseases.

8th. To obtain incontestible results by intelligent experiments, upon scientific methods, as to the capacity of bees, under exceptional circumstances, to injure fruit, *i. e.*, to set at rest the ever-discussed question of bees *vs.* fruit.

— We have received from the author, M. A. Vayssière, memoire No. 3 of the second volume, zoölogy, of the Annales du Musée d'Histoire Naturelle de Marseille, entitled Recherches zoologiques et anatomiques sur les Mollusques opisthobranches du Golfe de Marseilles, 5, première partie, Tectibranches. This work fills 181 quarto pages, with six well-drawn plates, and is a product of the zoölogical laboratory founded by Professor Marion at Marseilles.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.— This body met at Ann Arbor, Mich., Wednesday August 26th, and terminated its sessions Tuesday September 1st, 1885, under the presidency of Professor H. A. Newton of New Haven. The officers of the meeting were as follows: Of Section E, vice president, Edw. Orton of Columbus, O.; secretary, H. Carvill Lewis of Philadelphia. Of Section F, Burt G. Wilder of Ithaca; secretary, J. A. Lintner of Albany. In the absence of Professor Wilder Professor T. J. Burrill of Champaign, Ill., took the chair. Of Section H, Wm. H. Dall of Washington, D. C.; secretary, Mrs. Erminnie A. Smith of Jersey City. In the absence of Mr. Dall, Mr. J. Owen Dorsey, of Washington, became chairman of the section. Section G was united with Section F. Its chairman was Mr. S. H. Gage of Ithaca; secretary W. H. Walmsley of Philadelphia.

The following papers were read:

Thursday, August 27th. *Section E—Geology.*—The geology of Ann Arbor, Alexander Winchell; Westward extension of rocks of the Lower Helderberg period in New York, S. G. Williams; Lower Silurian fossils in a limestone of Emmons' original Taconic, James D. Dana; Structure and relations of the Dakota Group, L. E. Hicks; Results from a study of the Gabbros and associated Amphibolites in Delaware, Frederick D. Chester; On the occurrence of trap rock in eastern Kentucky, A. R. Crandall; The quaternary deposits of Illinois, A. H. Worthen; Post-glacial changes of level in the basin of Lake Ontario, G. K. Gilbert; Sources of trend and *crustal surplusage* in mountain structure, Alexander Winchell; A probable cause of the shrinkage of the earth's crust, William B. Taylor.

Section F—Biology.—An observation on the hybridization and cross-fertilization of plants, E. Lewis Sturtevant; germination studies, E. Lewis Sturtevant; Biological deductions from a comparative study of the influence of cocaine and atropine on the organs of circulation, Dr. H. G. Berger; On the brain and auditory organs of a Permian Theromorph Saurian, Edw. D. Cope; Observations on the musk-rat, Amos. W. Butler; The question

of bisexuality in the pond-scums (Zygnemaceæ), Charles E. Bessey; The process in fertilization in *Campanula americana*, Charles R. Barnes; The structure of *Glottidea pyramidata* (Stim.) Dall, Dr. H. G. Berger; Cœnostroma and Idiostroma, and the comprehensive character of the Stromatoporoids, Alexander Windell; The song-notes of the periodical Cicada (*Cicada septendecim L.*), and the mechanism by which they are produced, C. V. Riley; The periodical Cicada in Southeastern Indiana, Amos W. Butler; Some popular fallacies and some new facts regarding *Cicada septendecim*, C. V. Riley; Proof that Bacteria are the direct cause of the disease in trees known as pear-blight, J. C. Arthur.

Section G—Histology and Microscopy.—Photo-micrographs on gelatine plates for lantern projection, W. H. Walmsley; Photo-Micrography work with high powers, Professor T. J. Burrill; A new, cheap, useful and quickly constructed adjustable microtome, Chas. Porter Hart; Optical arrangements for Photo-micrography, and remarks on magnification, Romyn Hitchcock.

Section H—Anthropology.—A visit to the Siletz Agency, Rev. J. Owen Dorsey; Permanence of early Iroquois Clans and Sachemships, Rev. W. M. Beauchamp; The remains at San Juan Teotihuacan, Amos W. Butler; Significance of Flora to the Iroquois, Mrs. Erminnie A. Smith; A supposed natural alloy of copper and silver from the north shore of Lake Superior, in Minnesota, N. H. Winchell; Exhibition of copper implements, W. C. Wyman.

Friday, August 28th. *Section E—Geology and Geography*—On the Classification of the upper Devonian, Henry S. Williams; The Gas and Oil Wells of Northwestern Ohio, Edward Orton; The Loess and Drift-clays, Wm. McAdams; Discovery of fossiliferous Potsdam Limestone, at Poughkeepsie, N. Y., William B. Dwight.

Section F—Biology.—On the parasites of the Hessian fly (*Cecidomyia destructor* Say), C. V. Riley; The mechanical injury to trees by cold, T. J. Burrill; Aquatic respiration in soft-shelled turtles (Aspidonectes and Amyda); A contribution to the physiology of respiration in vertebrates, Simon H. Gage and S. S. Phelps Gage; The presence or absence of underbasals in crinoids can be ascertained from the columns, Charles Wachsmuth; Further observations on the adventitious inflorescence of *Cuscuta glomerata*, Charles E. Bessey; On the phylogeny of the placental mammalia, Edward D. Cope; The structure of *Glottidea pyramidata* (Stim.) Dall, Dr. H. G. Beyer.

Section H—Anthropology.—Sacred war tent and some war customs of the Omahas, Alice C. Fletcher; Laws and terms of relationship of the Omahas, Francis LaFlesche; Exploration of recent Indian mounds in Dakota, William McAdams; Burial customs of our aborigines, Henry Gillman; Ancient pictographs

in Illinois and Missouri, William McAdams; Exhibit of specimens with notes, W. L. Coffinberry; Customs, language, and legends of the Senecas, J. W. Sanborn.

Monday, August 31st. *Section E—Geology and Geography.*—A new mass of meteoric iron from Charleston, Kanawha Co., West Virginia, George F. Kunz; Mineralogical notes: curious form of beryl from Auburn, Maine, capped garnet from Raymond, Maine, and an artificially stained turquoise from New Mexico, George F. Kunz; The tourmaline locality at Rumford, Oxford Co., Maine, George F. Kunz; A pseudomorph of feldspar after leucite (?) from Magnet Cove, Arkansas, George F. Kunz; Notes on a remarkable collection of rough diamonds, George F. Kunz; Native antimony and its associations at Prince William, York Co., N. B., George F. Kunz; The record of the deep well of the Cleveland Rolling Mill Company, Cleveland, Ohio, Edward Orton; The materials of the Appalachians, E. W. Claypole; Apatite deposits in Laurentian rocks, T. Sterry Hunt; Glaciation of the Lackawanna valley, John C. Branner.

Section F—Biology.—On the appearance of the relation of ovary and perianth in the development of dicotyledons, John M. Coulter; A new membrane of the human skin, Charles Sedgwick Minot; The development of the prothallium of ferns, D. H. Campbell; Organization and death, Charles Sedgwick Minot; Morphology of the supra-renal capsules, Charles Sedgwick Minot; The importance of individual facts of environment in the formation of groups of animals, J. B. Steere; Experiments antagonizing the view that the serrulæ (serrated appendages) of Amia are accessory organs, Burt G. Wilder; The structure of the human placenta, Charles Sedgwick Minot; On the structure and functions of Sphæridia of the Echinidæ, Howard Ayers; On the carapax and sternum of the decapod Crustacea, Howard Ayers; Notes on some injurious fungi of California, W. G. Farlow; A new Chromogenous Bacillus (*Bacillus luteus suis*), D. E. Salmon and Thomas Smith; Evolution of the lungs, Charles Sedgwick Minot.

Section H—Anthropology.—Music in speech, M. L. Rouse; The stone ax in the Champlain valley, G. H. Perkins; The number habit, C. S. Minot; Indian personal names, J. Owen Dorsey; An average day in camp, Alice C. Fletcher; Are contemporary phantasms of the dead to be explained partly as folk lore? C. S. Minot; Ornaments made of pieces of human skulls, from a mound in Ohio, F. W. Putnam.

Tuesday, September 1st. *Section E—Geology and Geography.*—The Corniferous or Upper Helderberg group of Scott county, Iowa, and Rock Island, Ill., with a list of its fossils, A. S. Tiffany; The Chemung group at Burlington, Iowa, with a list of its fossils, A. S. Tiffany; Notice of Lingula and Paradoxides from

the red quartzites of Minnesota, M. H. Winchell; On the occurrence of trap-rock in eastern Kentucky, A. R. Crandall; Glaciation of the Lackawanna valley, John C. Branner.

Section F—Biology.—The structure of the human placenta, Charles Sedgwick Minot; Notes on some injurious fungi of California, W. G. Farlow; Evolution of the lungs, Charles Sedgwick Minot.

Section H—Anthropology.—Extracts from the address of the vice-president; "The Native Tribes of Alaska," W. H. Dall; On certain singular stone implements from Vermont, G. H. Perkins; Explorations in the great Cahokia mounds, Wm. McAdams; Proper methods of exploring mounds, etc., F. W. Putnam; Who made belt wampum? with exhibits, Erminnie A. Smith; Primary classifiers in Dhegiha and cognate languages, J. Owen Dorsey; Exhibition of copper implements, W. C. Wyman; The Degeneracy of Races, Wm. Zimmerman; The Animal Mounds of Wisconsin, W. DeHass; Archæological Remarks, W. DeHass.

The place of meeting for 1886 was decided to be Buffalo, New York.

The following officers were elected for the year 1886: President, E. S. Morse, of Salem, Mass.; vice-presidents, A—Mathematics and astronomy, J. W. Gibbs, of New Haven, Conn.; B—Physics, C. F. Brackett, of Princeton, N. J.; C—Chemistry, H. W. Wiley, of Washington, D. C.; D—Mechanical science, O. Chanute, of Kansas City, Mo.; E—Geology and geography, T. C. Chamberlin, of Washington, D. C.; F—Biology, H. P. Bowditch, of Boston, Mass.; H—Anthropology, Horatio Hale, of Clinton, Ont.; I—Economic science and statistics, Joseph Cummings, of Evanston, Ill.; permanent secretary, F. W. Putnam, of Cambridge, Mass. (holding over); general secretary, S. G. Williams, of Ithaca, N. Y.; assistant general secretary, W. H. Pettee, of Ann Arbor, Mich.; secretaries of the sections, A—Mathematics and astronomy, S C. Chandler, of Cambridge, Mass.; B—Physics, H. S. Carhart, of Evanston, Ill.; C—Chemistry, Wm. McMurtrie, of Champaign, Ill.; D—Mechanical science, William Kent, of Jersey City, N. J.; E—Geology and geography, E. W. Claypole, of Akron, Ohio; F—Biology, J. C. Arthur, of Geneva, N. Y.; H—Anthropology, A. W. Butler, of Brookville, Ind.; I—Economic science and statistics, H. E. Alvord, of Mountainville, N. Y.; treasurer, William Lilly, of Mauch Chunk, Pa.